American Machinist

FEBRUARY 13, 1947

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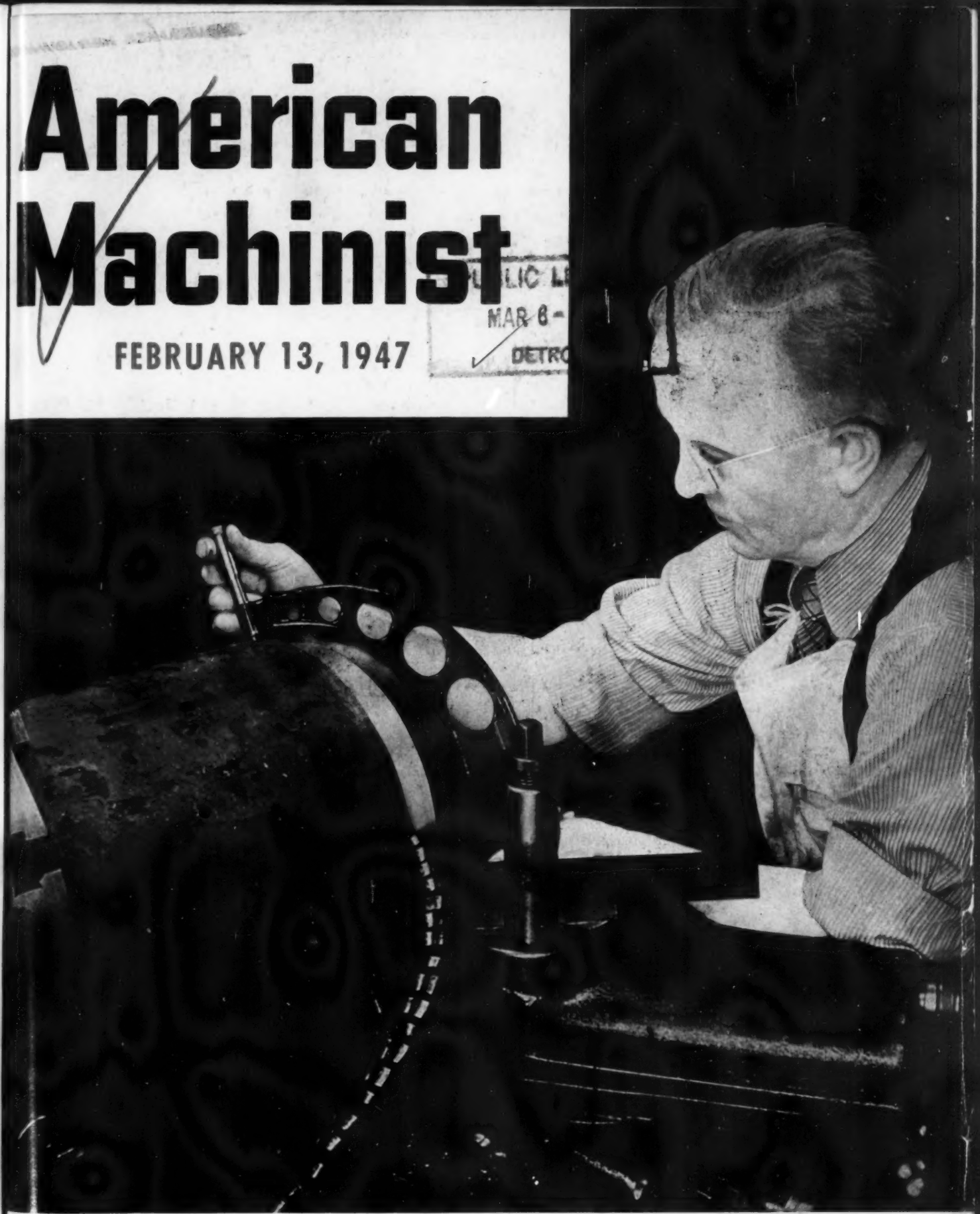

In this issue **QUALITY CONTROL**—*FIRST OF A SERIES*

DRAWING COMPOUNDS IMPROVE PRESS POTENTIALS

Increase production with this DOUBLE SLIDE Bore-Matic

Heald No. 42 Bore-Matic provides two-way slide motion at right angles

WHEN YOU'VE GOT a heavy production schedule to meet, here's the machine that can carry a double load. It's the Heald No. 42 Bore-Matic, incorporating two hydraulically-controlled slide movements at right angles.

Think how you can speed your work by combining boring, turning, plunge grooving and facing operations on this one machine—in a single automatic cycle. In addition, multiple stations substantially boost production; and simultaneous loading and borizing eliminate costly handling time.

The No. 42 Bore-Matic will perform both roughing and finishing operations on a wide variety of parts, such as connecting rods, pistons, pump housings and cylinder sleeves. For further information, get in touch with the Heald branch office nearest you, or write: THE HEALD MACHINE COMPANY, Worcester 6, Mass.

HEALD

means more precision . . . less cost

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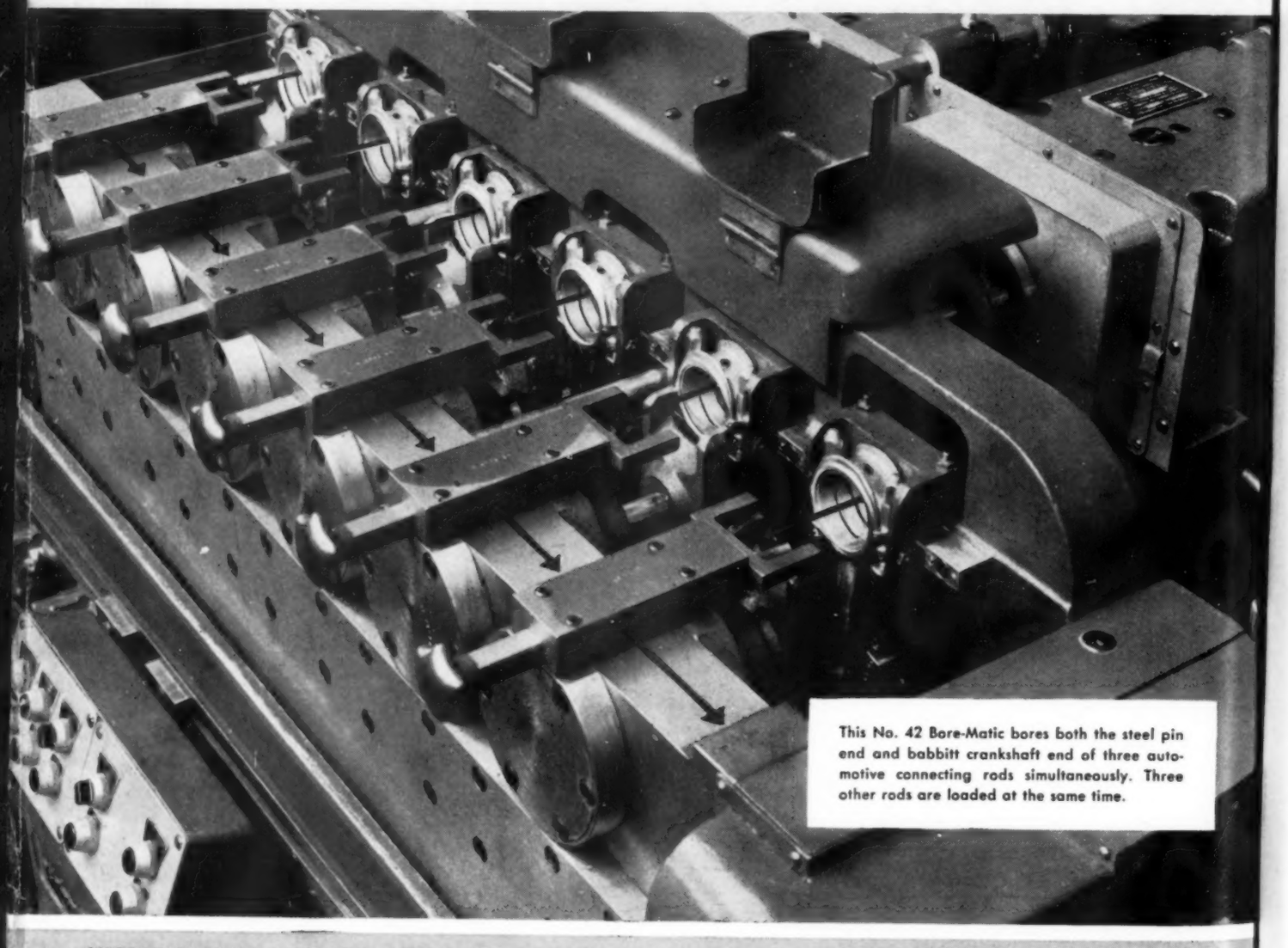

This No. 42 Bore-Matic bores both the steel pin end and babbitt crankshaft end of three automotive connecting rods simultaneously. Three other rods are loaded at the same time.

INTERNAL AND SURFACE GRINDING MACHINES • BORE-MATIC PRECISION FINISHING MACHINES

American Machinist

MAGAZINE OF METALWORKING PRODUCTION

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PUBLISHED BY McGRAW-HILL PUBLISHING COMPANY, INC.
330 West 42nd St., New York 18, N.Y. Cables: "McGRAW-HILL, New York"

James H. McGraw, Jr., President; James H. McGraw, Founder and Honorary Chairman; Curtis W. McGraw, Senior Vice-President and Treasurer; Nelson Bond, Director of Advertising; Eugene Duffield, Editorial Assistant to the President; Joseph A. Gerardi, Secretary; J. E. Blackburn, Director of Circulation.

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Published every other Thursday. Price 35c per copy. Allow ten days for change of address. Subscription Rates: United States and possessions, $5 a year, $8 for two years, $10 for three years. Canada, $6 for one year, $10 for two years, $12 for three years. Pan-American countries, $10 for one year, $16 for two years, $20 for three years. All other countries, $20 a year, $30 for two years, $40 for three years. Please indicate position and company connection on all subscription orders. Entered as second-class matter, August 13, 1943, at Post Office, New York, N. Y., under the act of March 3, 1879. Printed in U.S.A. Return postage guaranteed.

Chips and QUIPS

Here's How . . . An instructor in the apprentice school at Chevrolet Gear & Axle, Detroit, shows how it's done—one of the series of Kodachromes in the current slide film of Allegheny Ludlum Corporation on high-speed steels.

Drawing Dope . . . A year ago, we planned a report on forming, found from press manufacturers that the major recent improvement was in speed of drawing, made possible by development of new compounds. Further requests to press and oil companies indicated the expert was Sam Spring of Frankford Arsenal (see biog. below). Sam is a very busy man, but we're persistent. Result: A 12-page report herewith, put together from hand and typed copy, dictated records, half a dozen trips to Philly, phone calls—everything but carrier-pigeon messages. You'll find it worth all this —and more.

Model Shop . . . Reader interest in three-dimensional models for shop layouts prompted us to ask L. A. Bell of Westinghouse to show you, step by step, how you can make your own, if necessary. Which he does—and well.

Suggestion . . . An idea that seems well worth while for our Annual Review comes from Anthony Marcellus of Norwood, Mass. He points out his requests for catalogs have sometimes been answered with incomplete or incorrect literature, suggests that Annual Review ads incorporate the numbers and titles of catalogs and circulars available on the equipment advertised —or even all literature the company offers. Thus he asks for catalog-style advertising in an annual catalog, a logical request.

Quality Control . . . So many ideas have been going the rounds on quality control, we figured we'd better put down the basic facts for all concerned. Otherwise, the words will soon apply to as many different things as does "bulldozer." David Armstrong offered to do the onerous sifting job for us, so here is the first of a series of four articles to establish a common ground.

Formula for Slicing . . . Take one wheel from a pipe cutter, hone it to a razor edge, put in on a bench lathe. That cuts thin-wall tubes of any material at high speed, as it's done at Eversharp, and described in pictures in this issue. . . . Another picture article shows Alco's preparing and handling of locomotive boiler shells for welding. . . . Master Mechanic Brooks tells how Nineteen Hundred Corp. solved an assembly-line supply problem when aisles proved too narrow for industrial trucks.

Specials . . . Chief Metallurgist Roberts of Vanadium Alloys has put together the real lowdown on nitriding high-speed steels. . . . Then we've gotten from Hotpoint the details of application of a roller-conveyor turntable in dishwasher assembly, and from C. H. Mehaffey of Mine Safety Appliances a summary of the things that foul shop air and what to do about them . . . With regular departments, it's a busy issue.

Coming Feb. 27 . . . A special report on the Annual Wage in Metalworking, a cover picture and inside story of the conveyor setup that reduces process lag for General Instrument, jig-boring time and money saving ideas, tool racks at Warner & Swasey, how to get good X-ray negative details, and part 2 on quality-control fundamentals . . . Leading the issue is a bang-up series of suggestions for "Seeing the Foreman Through to Security."

LUBRICATION SPECIALIST . . . Sam Spring, who provides our current special report on drawing compounds, is group leader of the Industrial Chemistry Section, at Frankford Arsenal, working mainly on metal-drawing lubrication, coolants and metal cleaning. Research and resulting applications during the war saved over $500,000. He holds one patent, has applied for several others, and has authored 10 articles on his specialties.

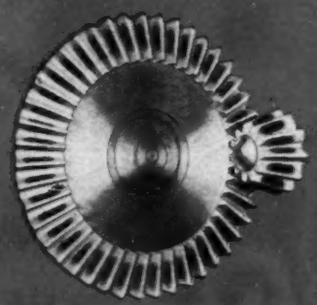
Mr. Spring holds a B.S. from the College of the City of N. Y. (1936), is a member of Phi Beta Kappa, and has his masters degree in chemistry from Columbia. He taught at C.C.N.Y., Brooklyn College and Drexel, has worked in the field, and has been successively junior, asst., associate, chemist and more recently senior chemist at the Arsenal.

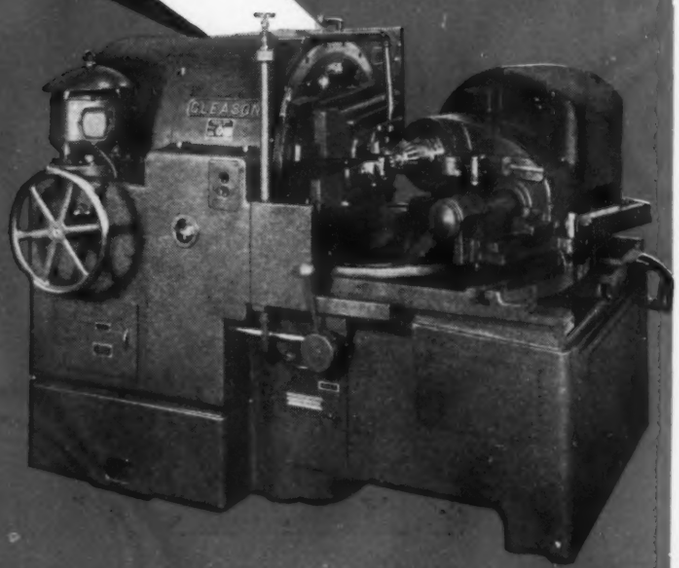
PRODUCE
CONIFLEX* GEARS FOR

1. Wider operating tolerances—allowing slight deflections in operation without dangerous concentration of the load at the ends of the teeth.
2. Smoother quieter operation—localization of tooth contact in Coniflex gears assures a good tooth bearing under operating loads.
3. Easier assembling—slight amounts of adjustment are allowable in assembly.

GLEASON
12" B STRAIGHT
BEVEL GENERATOR

Write for information on this development to produce the latest in straight bevel gears...the Coniflex* gear...positive advance of the tool slides through cam action at each end of the cutting stroke relieves the ends of the gear teeth resulting in a localized tooth bearing.





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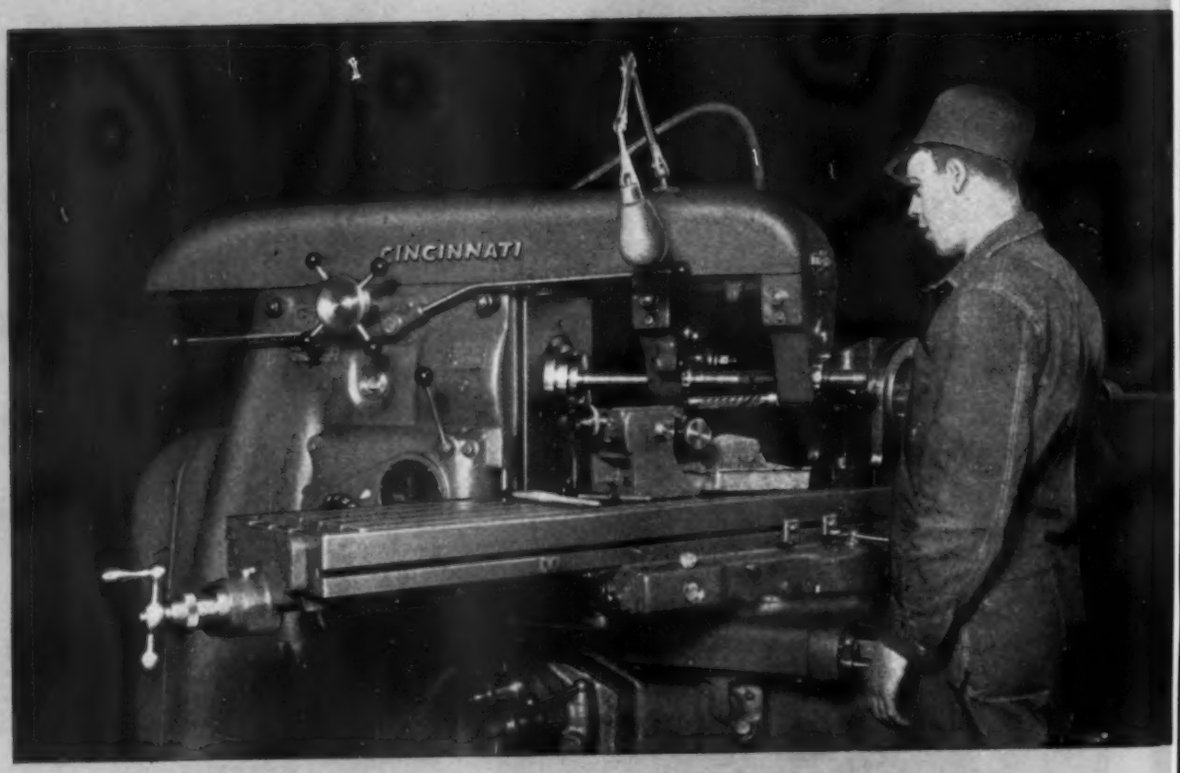
***CONIFLEX—THE BEVEL GEAR WITH LOCALIZED TOOTH BEARING**

Builders of Bevel Gear Machinery for Over 80 Years

OPERATOR PREFERENCE . . . . .

means a lot in toolroom



CINCINNATI No. 4 Universal Dial Type Miller, in a railroad shop, milling a helical reamer.

THE CINCINNATI MILLING

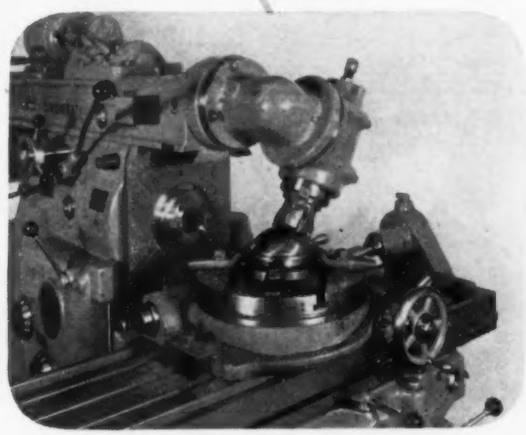
MILLING MACHINES

CINCINNATI

milling!

Get ready, get set, go! Repeat it a dozen or more times a day, never under identical conditions, and you have an idea of the broad, general pattern followed by the operator of a toolroom miller. He sets up the job, mills a few parts, tears down the setup, and then gets ready for a totally different job. Because of the necessarily intimate contact with *all* the features of his machine, the toolmaker is in a position to know what really counts in a toolroom miller. ¶ Speeds and feeds must be changed for each setup, and perhaps several times for some individual setups . . . *CINCINNATI Dial Types do it by power.* Some jobs are more conveniently run from the front of the machine, others from the rear . . . *CINCINNATI Plain and Universal Dial Types have complete manual and power controls at both front and rear operating positions.* Toolroom milling requires a lot of starting and stopping . . . *the CINCINNATI Dial Type clutch is hydraulically energized, relieving the operator of much effort.* Adjustments of work to cutter must be accurate . . . *CINCINNATI Dial Types have large micrometer dials on the hand cranks, easy to reset, graduations clearly visible.* ¶ There are a host of additional Dial Type features which are preferred in toolroom milling. For a complete description and engineering specifications, write for catalog M-1499.

CINCINNATI Universal Dial Type Milling Machine. The Dial Types are available in Plain, Universal and Vertical styles, Nos. 2, 3 and 4 sizes, in Medium and High Speed Ranges.



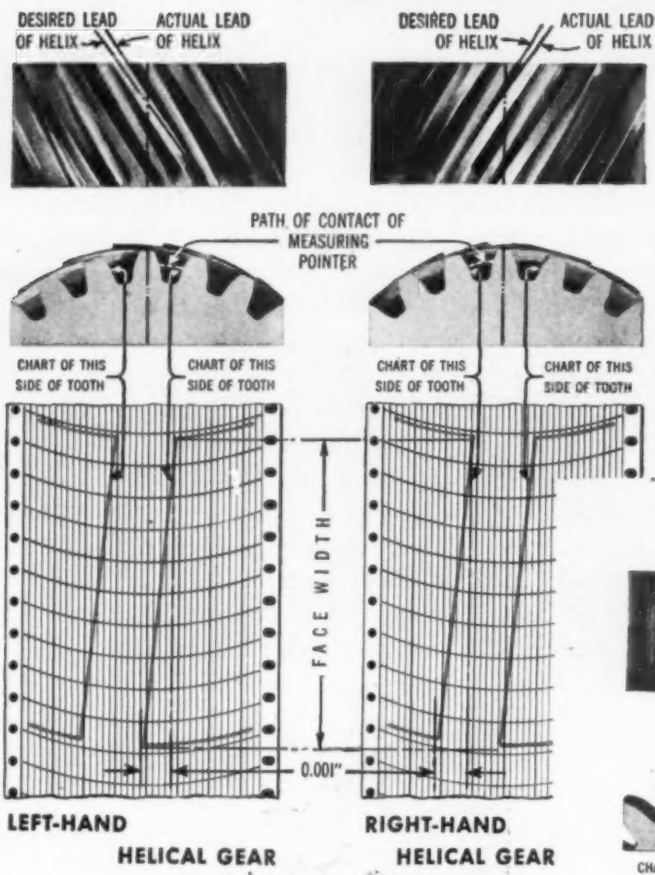
CINCINNATI Dial Type Milling Machine equipped with Motor Driven Universal Milling Overarm Attachment. This is one of many attachments available for use on the Dial Types.

MACHINE CO. CINCINNATI 9, OHIO, U. S. A.

BROACHING MACHINES • CUTTER SHARPENING MACHINES

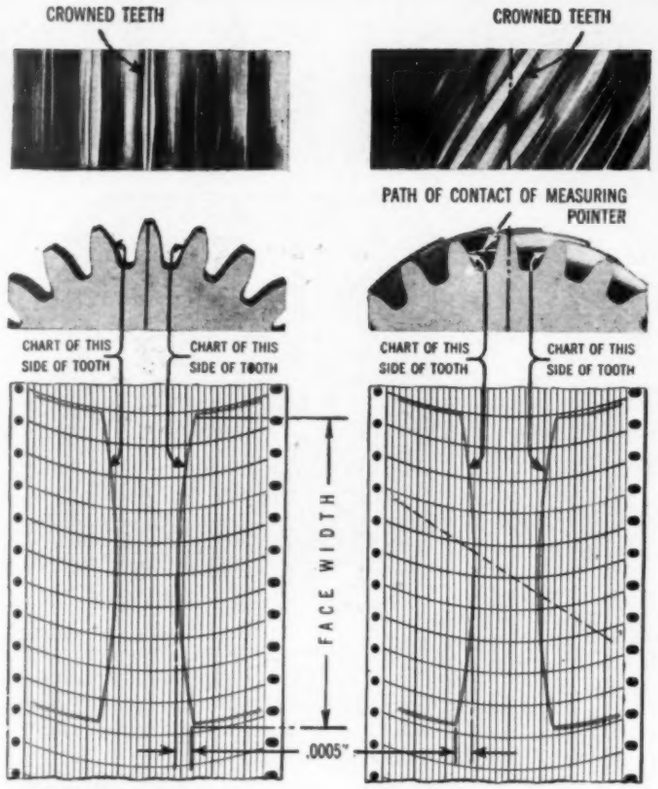
Graphically Charted OF LEAD, CROWN

...with the Newest


DESIRED LEAD OF HELIX
ACTUAL LEAD OF HELIX
DESIRED LEAD OF HELIX
ACTUAL LEAD OF HELIX
PATH OF CONTACT OF MEASURING POINTER
CHART OF THIS SIDE OF TOOTH
CHART OF THIS SIDE OF TOOTH
CHART OF THIS SIDE OF TOOTH
CHART OF THIS SIDE OF TOOTH
FACE WIDTH
0.001"

LEFT-HAND HELICAL GEAR

RIGHT-HAND HELICAL GEAR


CROWNED TEETH
CROWNED TEETH
PATH OF CONTACT OF MEASURING POINTER
CHART OF THIS SIDE OF TOOTH
CHART OF THIS SIDE OF TOOTH
CHART OF THIS SIDE OF TOOTH
CHART OF THIS SIDE OF TOOTH
FACE WIDTH
.0005"

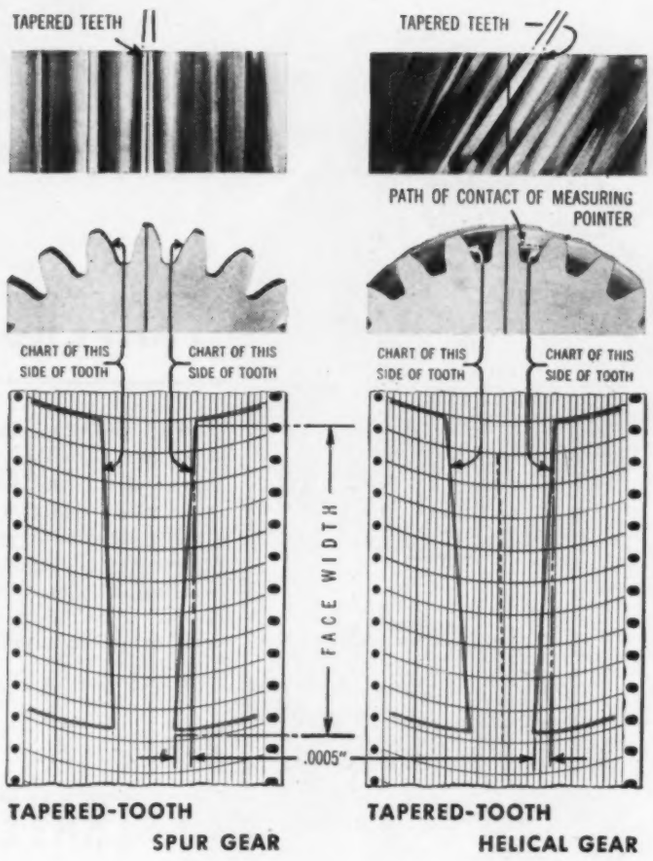
CROWNED-TOOTH SPUR GEAR

CROWNED-TOOTH HELICAL GEAR

THE FELLOWS METHOD...MACHINES AND TOOLS FOR

Inspection AND TAPER

Fellows Inspection Instrument



The No. 12H Fellows Lead Measuring Instrument presents an outstanding development in the art of checking gears. For simplicity of set-up and operation it cannot be equalled... a complete change in set-up, for the average gear, in less than 5 minutes!

In addition to checking by means of a one-ten thousandth dial indicator, a recorded chart graphically enlarges departures from theoretical perfection 500 times. Like all Fellows Recording Inspection Instruments, its functioning can be easily and definitely checked. The instrument by means of a master verifies its own accuracy!

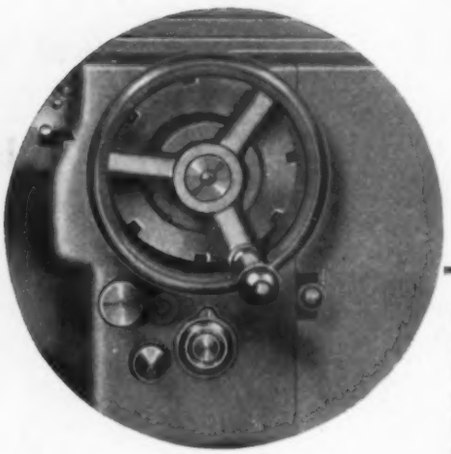
This new basic Inspection Instrument is fully explained and illustrated in a circular awaiting your request. The Fellows Gear Shaper Company. Head Office and Export Dept., Springfield, Vermont, U.S.A. Branch Offices...616 Fisher Bldg., Detroit... or 640 West Town Office Bldg., Chicago.

Fellows

ALL OPERATIONS FROM BLANK TO FINISHED GEAR

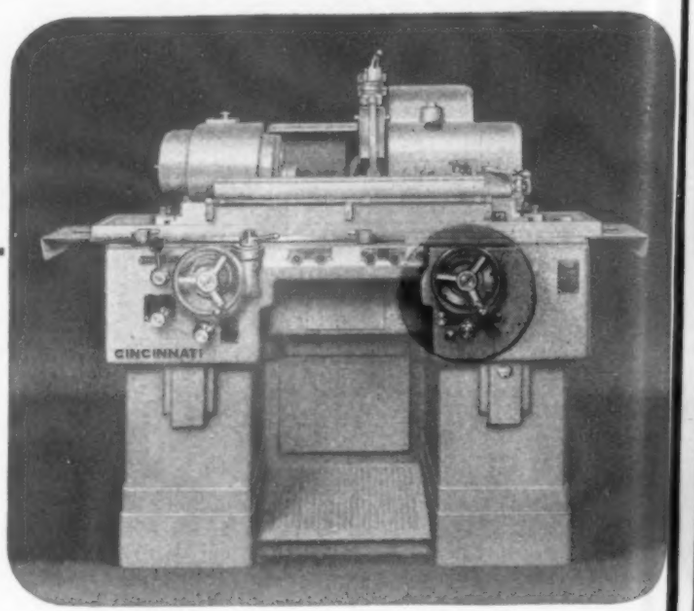
CINCINNATI FILMATIC 4″ PLAIN

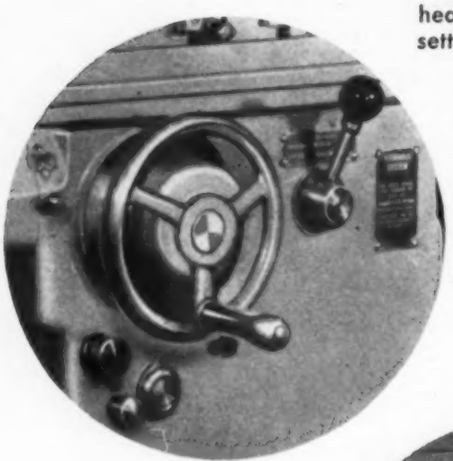
ARE AVAILABLE IN



TRAVERSE

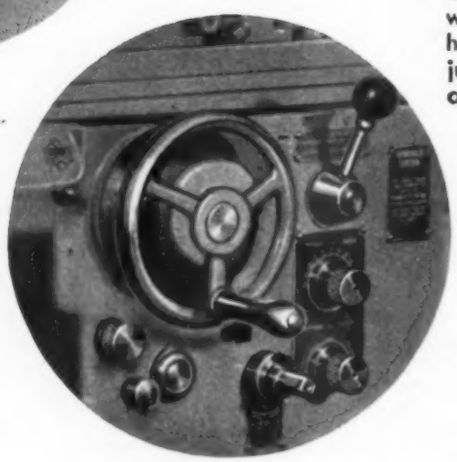
The standard machine, built primarily for *traverse work*, has hand and power control of table movement, and conventional hand operation of the wheelhead cross slide for setting up the machine.





TRAVERSE AND HAND INFEED . .

In addition to all basic elements of the standard machine, this style includes a hydraulically actuated rapid advance and return of the wheelhead unit controlled by the cross feed hand wheel. Wheelhead has ⅜″ to 1″ adjustable stroke . . . a safety factor in loading and unloading, and gaging the work.



AUTOMATIC INFEED

CINCINNATI

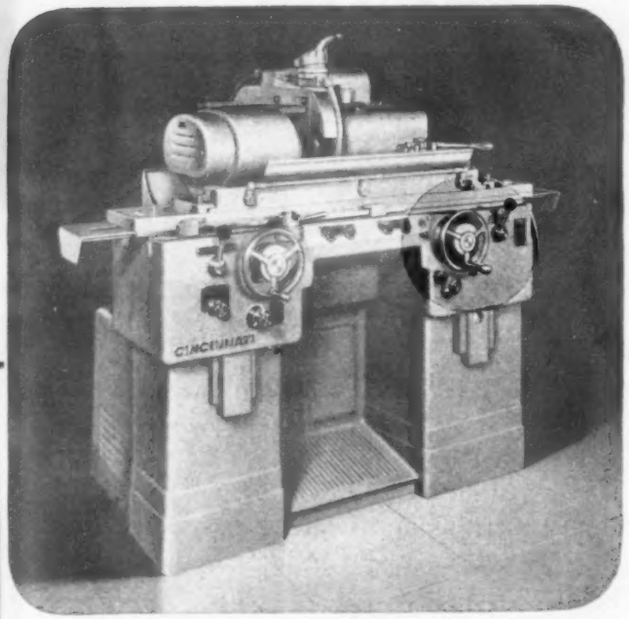
CINCINNATI GRINDERS

CENTER TYPE GRINDING MACHINES

HYDRAULIC GRINDERS

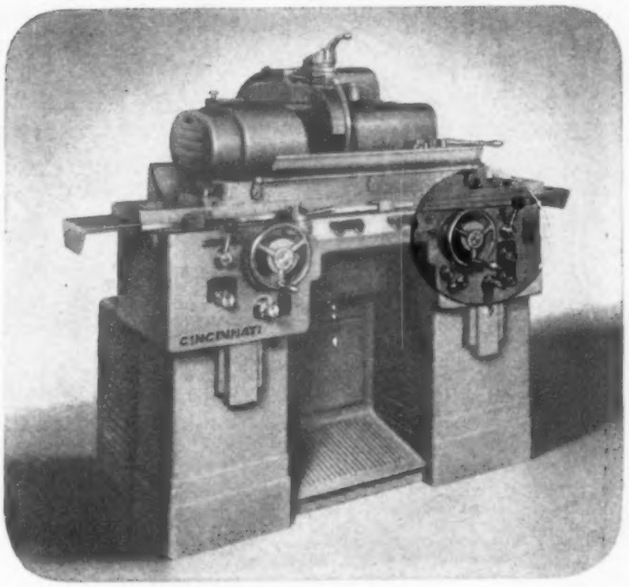
THREE STYLES

• Your small precision ground work may require traverse cycles only, it may be divided between traverse and infeed cycles, or it may be mostly infeed cycles. Whatever your requirements, one of the new CINCINNATI FILMATIC 4" Plain Hydraulic Grinders will fit your kind of work. ¶ This machine is built in three styles: (1) for traverse operations; (2) for traverse and hand infeed operations; (3) for traverse and automatic infeed operations. In the latter style, a *single lever* controls the infeed cycle. Many other features give these 4" machines high productive capacity for either small or large quantities of traverse and infeed work. ¶ They are built in 4" x 12" and 4" x 18" sizes. Complete engineering specifications may be obtained by writing for catalog G-551. Sweet's Catalog File for Mechanical Industries contains a brief description of these machines.



AND TRAVERSE . . .

This machine includes a full automatic infeed cycle to the wheelhead. The automatic cycle, initiated by a single lever, consists of rapid advance of wheelhead to grinding position, feed to depth of cut, tarry to spark-out, rapid retract wheelhead and stop cycle. Wheelhead has 3/8" to 1" adjustable stroke to facilitate loading.



INCORPORATED

CINCINNATI 9, OHIO, U. S. A.

CENTERLESS GRINDING MACHINES • CENTERLESS LAPPING MACHINES

ACTUAL SIZE

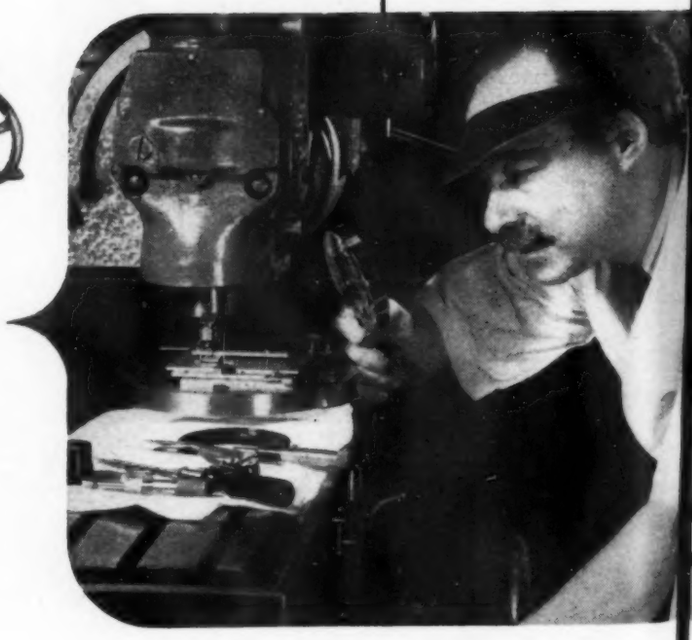
MILL SPRING

TO .0028"

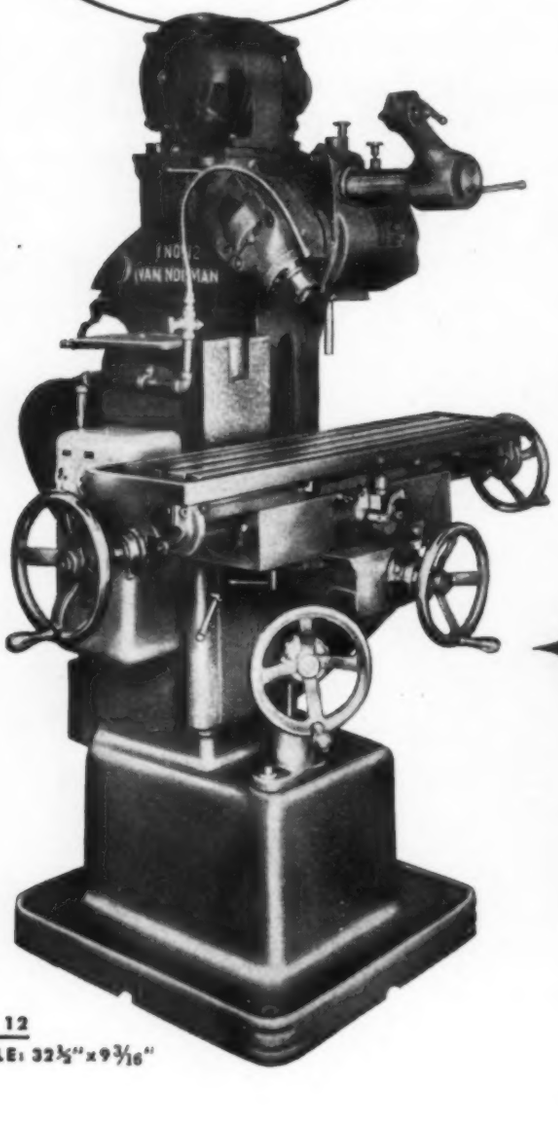
THICKNESS

± .0001"

This Precision Work Pe



With head in vertical position, Mr. V. E. vanHoesen is boring a drill jig. So small and precise is the work that a magnifying glass is used.



NO. 12
TABLE: 32½" x 9 3/16"

FOR PRECISION MILLING ..

Work so fine and precise that a magnifying glass must be used to perform the milling operations . . . that's typical of accurate work that is done on Van Norman Ram Type Milling Machines. Illustrations below show some of the milling operations performed in making a marine chronometer detent.

Note the facts as stated by Mr. V. E. vanHoesen, watchmaker, A. Graves & Steuwer Company, Memphis, Tenn., who performed the work.

"Inertia and force of the detent spring must be reduced to the very lowest point consistent with its functions, therefore, it is necessary that this spring be extremely thin.

"We milled this spring to a thickness of .0028 inches and were successful . . . in having less than five percent spoilage in this operation and tolerance was easily held within plus or minus .0001 inches.

"On the part made of nickel, width of the shallow lengthwise slot had to be maintained within plus or minus .0001 inches and absolute parallelism was necessary with the face containing the dowel pins.

"As to the small S shaped piece, the fact that this angle bracket fitted into the assembly without dowel pins shows the type of tolerances which had to be maintained here.

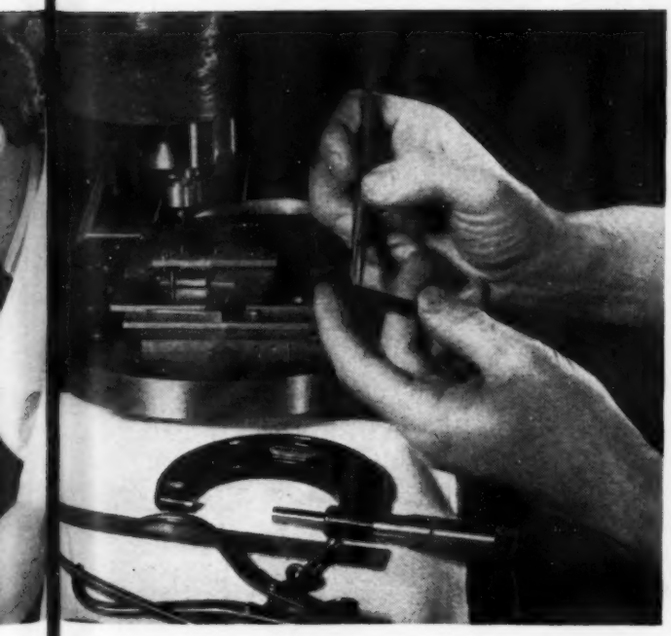
"All drill jigs and milling fixtures for the job were jig-bored on the machine."

In addition to accurate performance, Van Norman Ram Type Millers increase production and cut milling costs. Write for information.

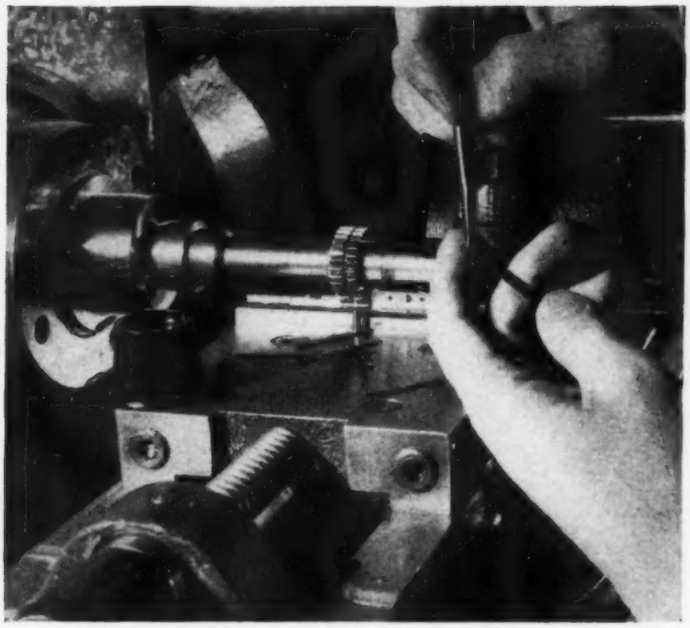
VAN NORMAN COMPANY

SPRINGFIELD 7, MASS.

Performed on the Van Norman No. 12



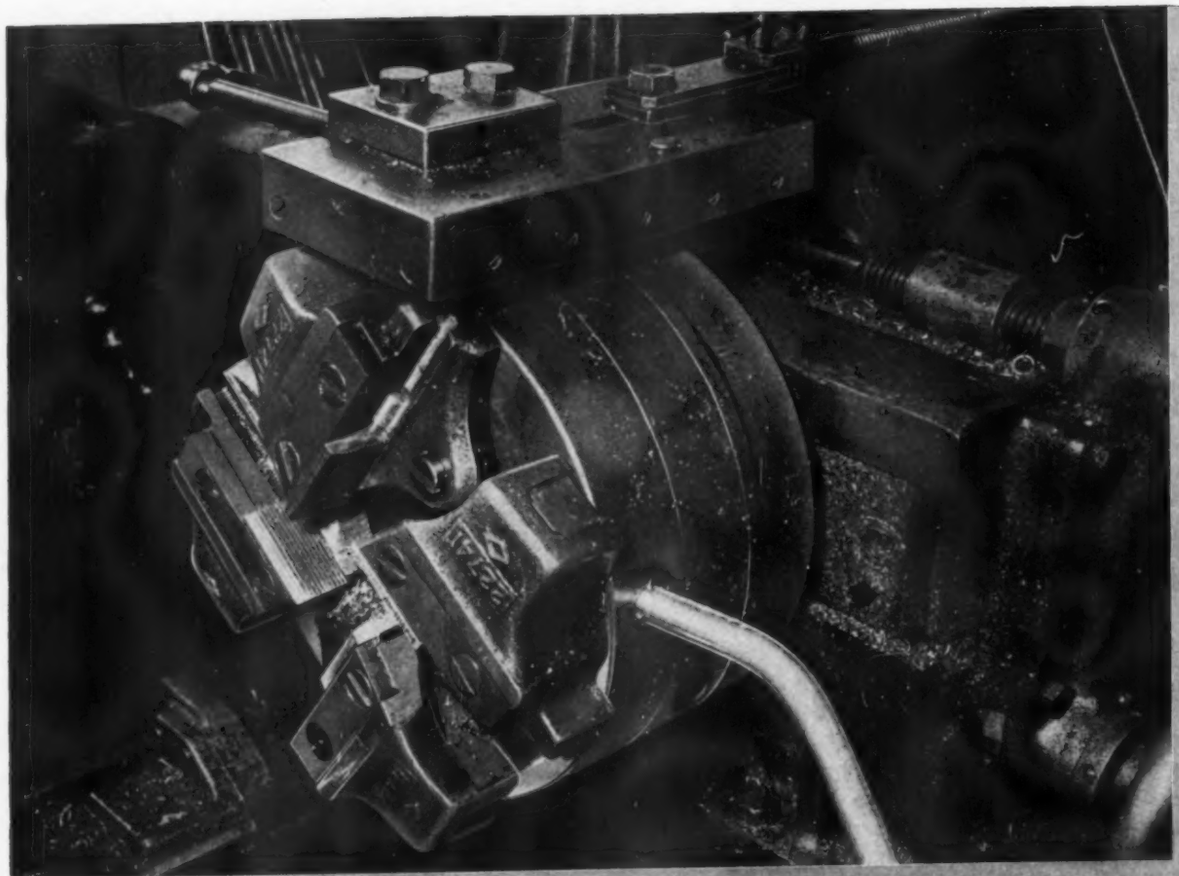
Checking the finished drill jig for accuracy. This is the largest of five jigs used in making the detents.

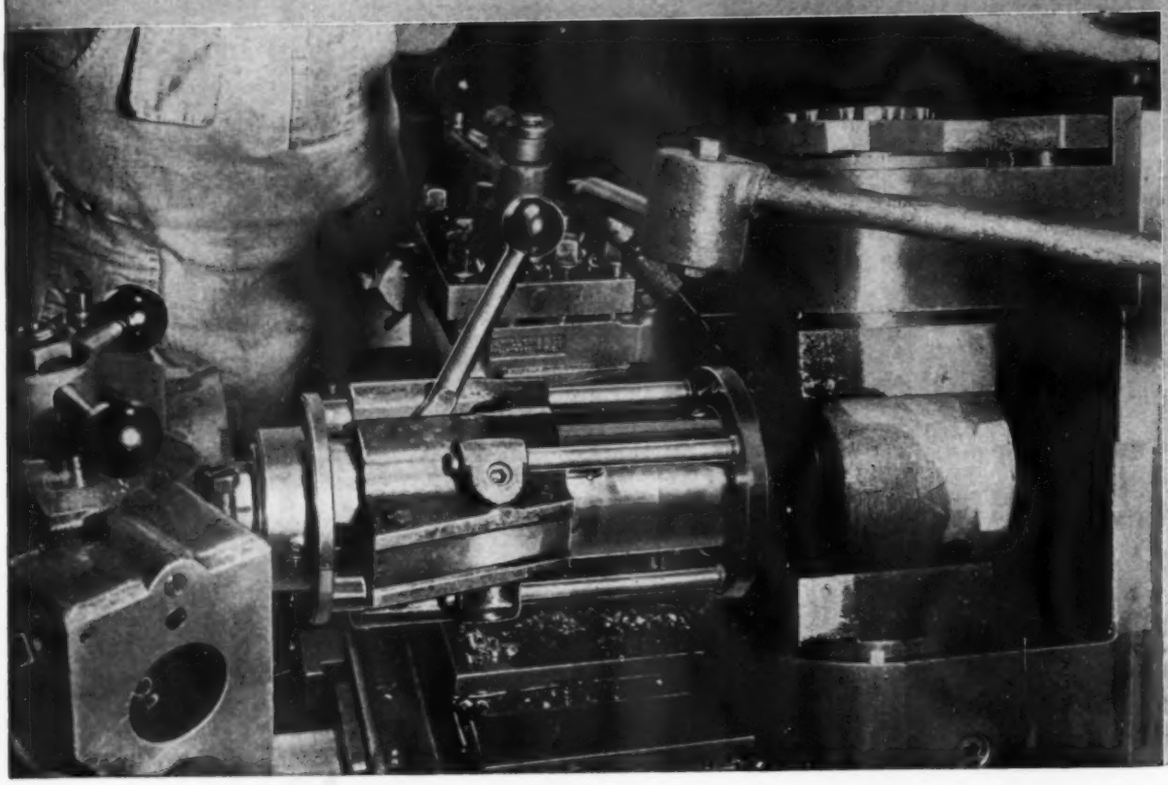


Operator checks the work piece after taking the horizontal gang milling cut.

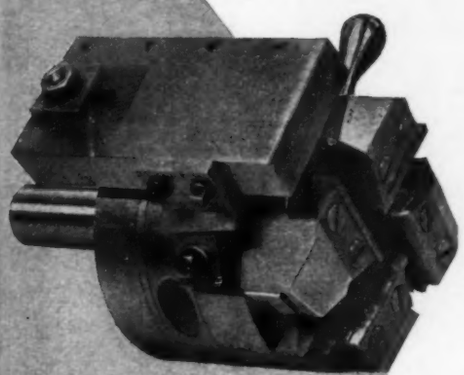
. . . "It Pays to Van Normanize"

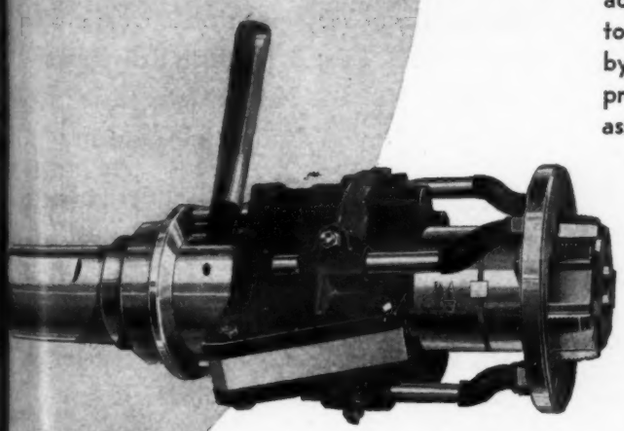
FOR INTERNAL





AND EXTERNAL
Tapered Threads





LANDIS THREADING EQUIPMENT PRODUCES WELL-FORMED AND EXTREMELY ACCURATE THREADED PARTS

Landis equipment is illustrated on the opposite page producing tapered pipe threads. At the top, the LANDMATIC Taper Attachment Die Head is applied to the Landis Pipe Threading and Cutting Off Machine for producing tapered threads on Stainless Steel Pipe. At the bottom, the Landis Style LM Receding Chaser Collapsible Tap is applied to a turret lathe to produce tapered pipe threads in 3" Stainless Steel Valve Body Castings. The Taper Attachment Die Head and the Collapsible Tap have also been illustrated separately to give a better view of their construction details.

The use of LANDMATIC Taper Attachment Die Heads and LM Receding Chaser Collapsible Taps enables an Eastern manufacturer of Stainless Steel Valves to thread parts in a highly efficient and satisfactory manner at minimum cost. The cutting action of the chasers used in the die heads and taps is limited to the throat section instead of over the entire width of the chaser by the receding mechanism of the tools. This makes possible the production of threads without chaser "leave-off" marks and assures smooth finished threads as well as long tool life.

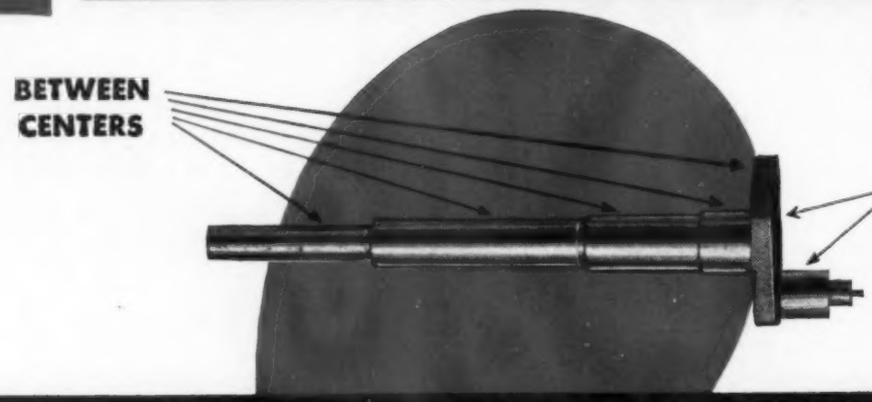
Write for Bulletins F-90—(Taper Attachment Die Head)
G-81—(Receding Chaser Collapsible Tap)

LANDIS TRADE MARK REG. U.S. PAT. OFF.

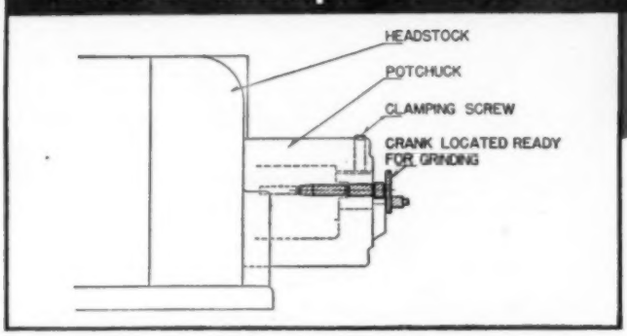
LANDIS
MACHINE COMPANY
WAYNESBORO, PA., U.S.A.

THREADING MACHINERY—THREAD CUTTING DIE HEADS—COLLAPSIBLE TAPS

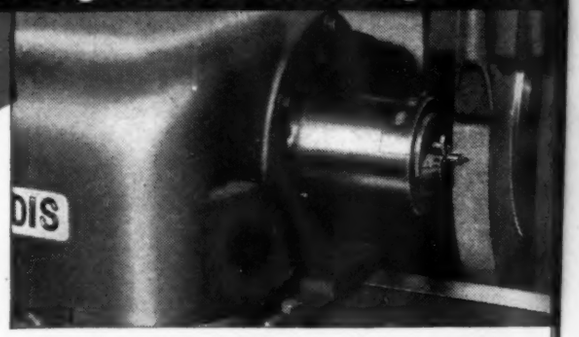
2 GRINDING JOBS ON



Another Example of LANDIS TOOL Engineered Grinding Service



Crank inserted in pot chuck and rotated for location radially



Crankshaft held in pot chuck ready for crank pin grind

Grinding this small crankshaft would ordinarily require two machines.

Landis Tool grinding engineers suggested that both between centers and chucking grinding operations could be done on one machine by use of a pot chuck. This resulted in a 40% reduction in machine investment, less work handling and greater output per man.

The 4" Type H Plain Hydraulic Grinder which was selected has these Landis Tool features that permit high production, fine finishes and close accuracy:

Microsphere Wheel Spindle Bearings
Dynamically Balanced Rotating Parts
Variable Voltage Headstock Drive
Stress Relieved Annealed Castings

Landis Tool Engineered Grinding Service will help you solve your grinding problem with the lowest cost solution to meet your requirements. Get in touch with your Landis Tool representative or write us full details. 56

LANDIS TOOL
Precision Grinders

LANDIS TOOL COMPANY WAYN

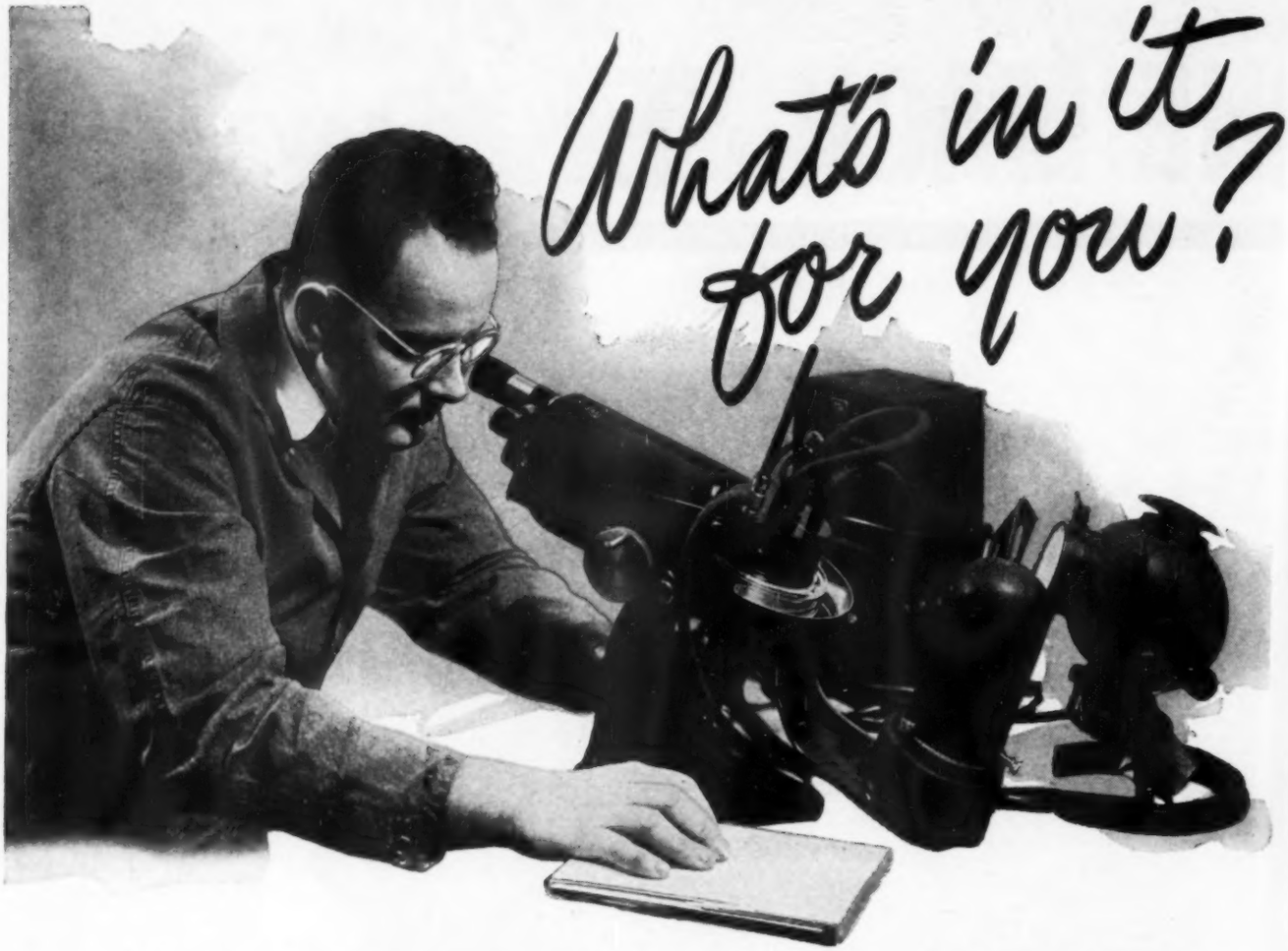
ONE MACHINE

SAVES
40%
Machine Investment

Type H Plain Hydraulic Grinder. Special Equipment: Combination live and dead spindle headstock, swing raised to 8", pot chuck. (Catalog A44).

LANDIS TOOL *Company*

WAYNESBORO, PENNA.



In this special machine there's plenty for you as a user of industrial lubricants. With the modern Refractometer, Sinclair Laboratory specialists keep posted on what's in your industrial lubricants. It shows them what properties to strengthen, so the finished product will perform best in any specific application.

Index of refraction and specific dispersion, determined by the Refractometer, is a measure of the chemical structure of lubricating oils. By use of such instruments as the Refractometer, Sinclair maintains important control points in the manufacture of dozens of industrial lubricants.

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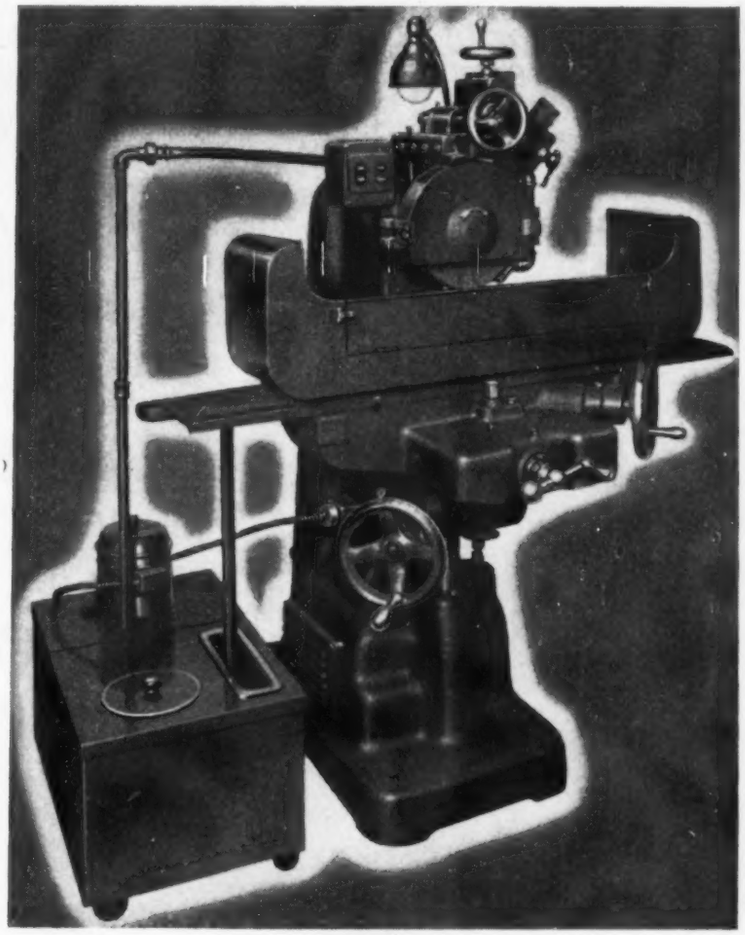
Proved in tool-room and on production line, this 6″ x 18″, hand feed surface grinder combines up-to-the-minute improvements in grinding machinery — and high standards of craftsmanship — to furnish you with a tool that will help lower costs and increase output. The No. 15 is one of the COVEL line of precision machine tools which includes: universal cutter and tool grinders, twist drill grinders, boring machines and precision vises.

Call your nearest dealer or write for Bulletin A-47.



Hardened, Precision Ground Ways on Top of Knee — one of the many COVEL features that guarantee long life.

COVEL MANUFACTURING CO.
BENTON HARBOR, MICHIGAN, U.S.A.

COVEL INDUSTRIAL GRINDERS

...and how does Your Reaming Go?

MORSE has the right REAMER to make it go

Smoothly...Accurately...at Lowest Cost

YOU'LL NEVER BE LEFT IN A HOLE . . . if you use Morse Reamers on every reaming job you have. In whatever type you need, Morse Reamers will do the job to your tolerances . . . smoothly . . . quickly . . . and keep on doing it time after time, far longer than your usual expectations.

For Morse Reamers are made to last . . . and last . . . and last. Like all Morse Tools, they are made to deliver the greatest number of cuts under proper working conditions . . . that is, when adequate metal is left in the hole to enable the Morse Reamer to perform *as it is designed to perform.*

All types of standard Morse Reamers . . . and special reamers, too . . . are available through your Industrial Supply Distributor. A few of these types of Reamers are shown on the facing page. In addition, Morse makes drills, cutters, taps, dies, and special tools which, like Morse Reamers, *will never leave you in the hole.* Ask your Industrial Supply Distributor to get you the Morse recommendation that will give you top reamer performance on *your* particular job.

No. 1653 Spiral Fluted Chucking Reamers: Straight shank or Morse Taper Shank. For use in stainless, chrome, nickel or molybdenum steel. Extra long life.

No. 1655 Fluted Chucking Reamers: For removing small amounts of metal to enlarge drilled holes and finishing them true and to size.

No. 1733 Expanding Chucking Reamers: When worn slightly below size, expand them slightly and regrind . . . and regrind . . . and regrind. One of these reamers does the work of many solid reamers.

No. 1701 Structural Reamer Spiral Flutes: Designed for use by Structural Workers, Boiler Makers, Bridge and Ship Builders. Made for severe and rough work, for reaming rivet and bolt holes in structural iron and steel work in buildings, bridges and ships as well as boiler plates. They are not ground close to size.

No. 1627 Shell Reamers with Spiral Flutes: Have taper holes, diameter being specified at the large end.

No. 1666 Stub Screw Machine Reamers: Furnished in decimal sizes where close tolerances are observed. For use in automatic machines where short tools are required.

Accuracy, Quality, Uniformity: the MORSE Code of Cutting-Tool Manufacture

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The Original Manufacturer of Twist Drills

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Need Extra Swing Capacity?

Perhaps you are troubled with one of those cylindrical grinding jobs that would normally be handled in the conventional 6", 10", 14" or 16" swing machine, except for one thing — flanges or projections that demand extra swing capacity!

To meet this problem, there's the Norton Type LC line of grinding machines. The additional swing for the flange or projection is provided not by raising blocks but by raising certain units "in the sand". Thus, you can be tooled to handle that extra swing job at minimum equipment cost — and with a machine that's really built to handle the extra swing.

Available in swing capacities of 10" — 14" — 20" and 24", these LC machines provide typical Norton trouble-free service.

Upon receipt of complete details of your work, Norton engineers will gladly suggest the proper machine for your job.

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Distributors in All Principal Cities

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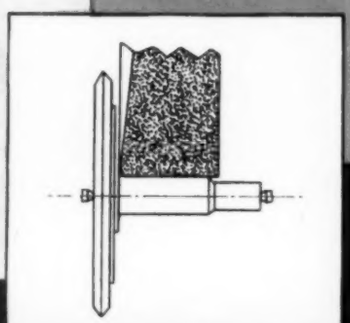
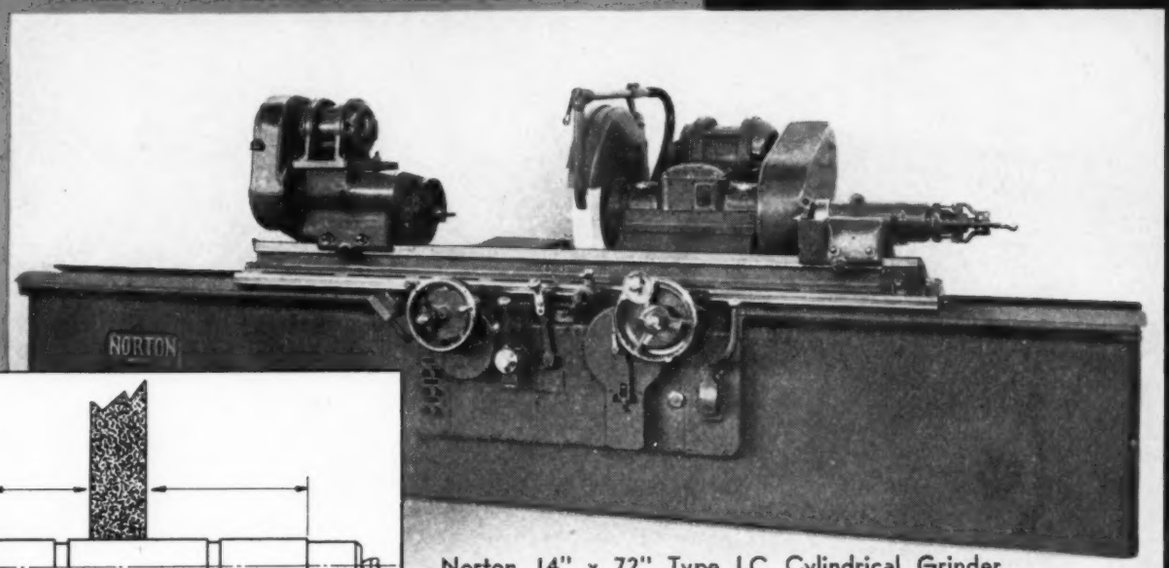
Norton 10" x 18" Type LC Cylindrical Grinder with hydraulic table traverse.

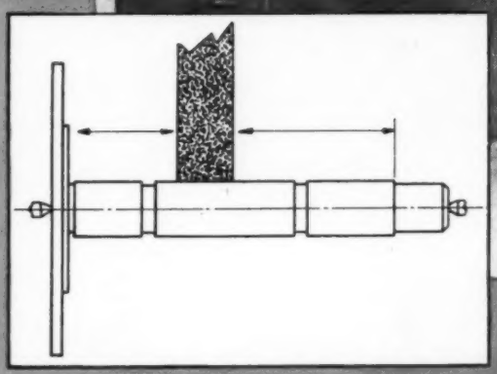


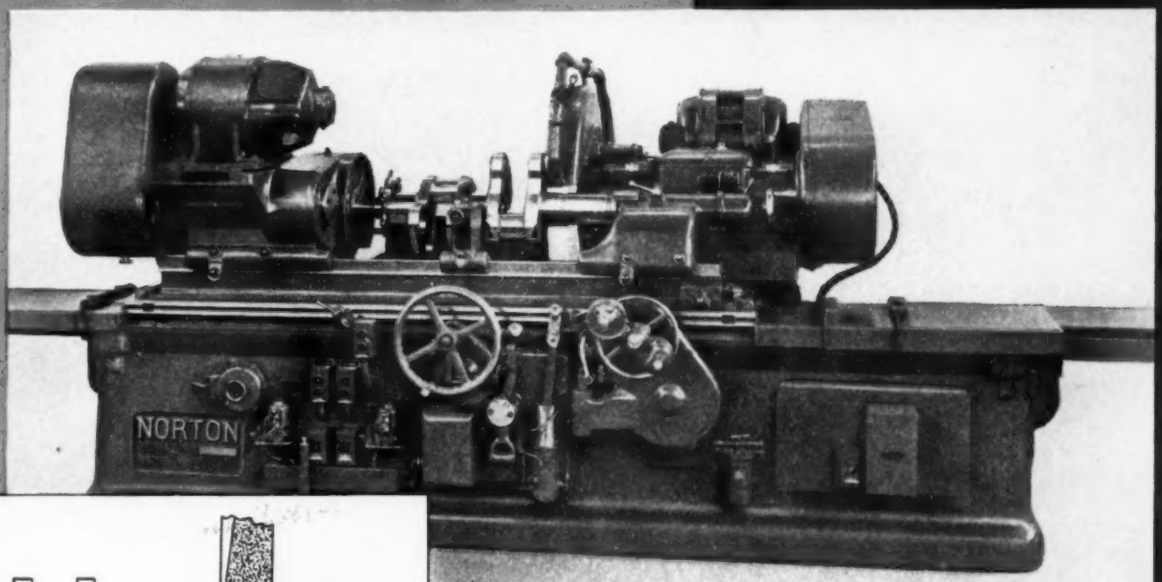
NORTON GRINDERS and Lappers

Your Answer may be the NORTON "LC" Line

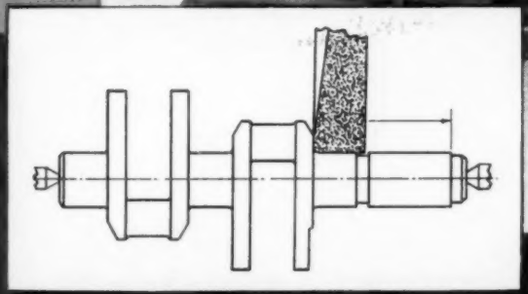


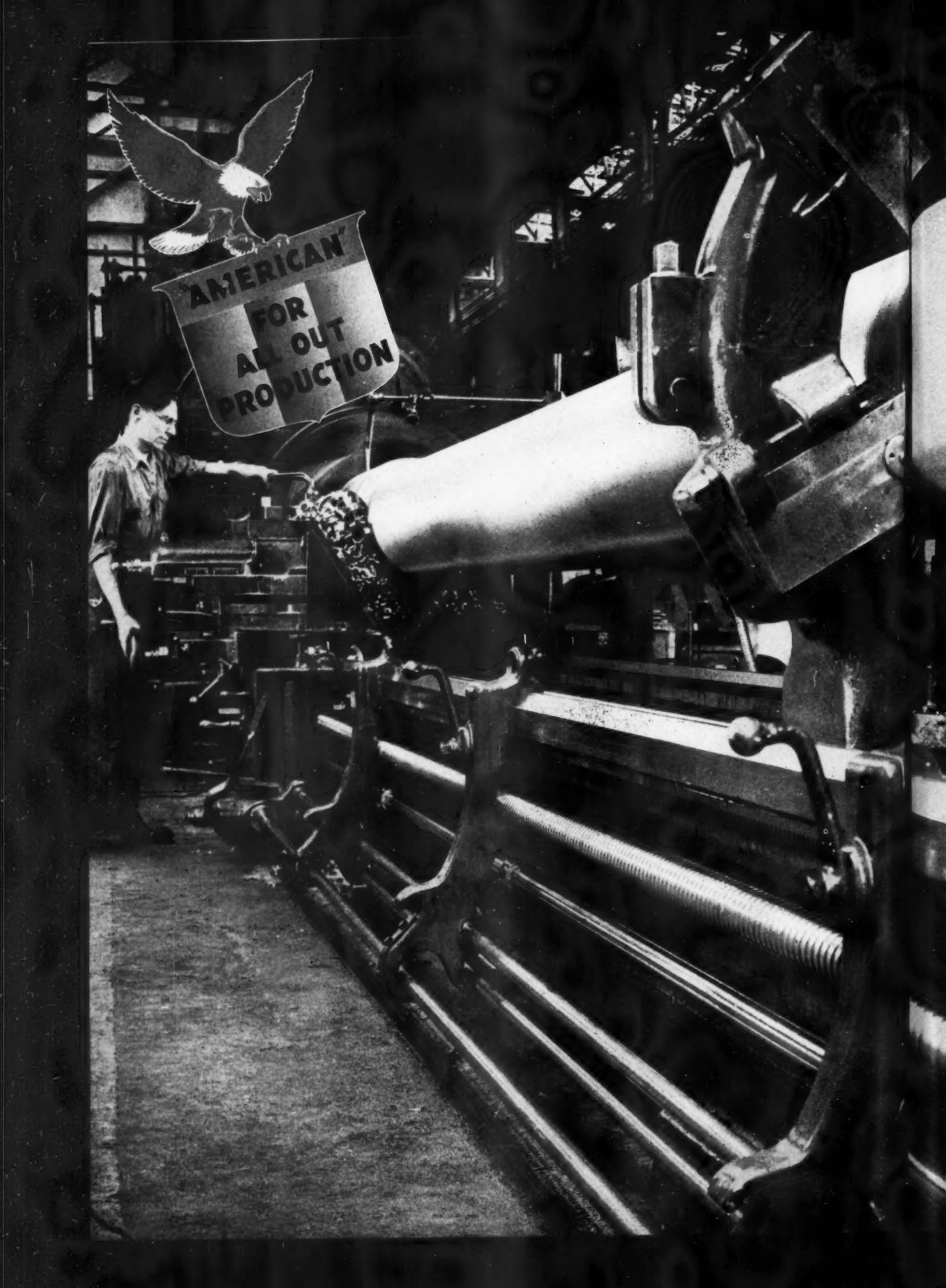
Norton 14" x 72" Type LC Cylindrical Grinder with hydraulic table traverse.





Norton 20" x 36" Type LC Cylindrical Grinder with hydraulic table traverse.

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FOR
ALL OUT
PRODUCTION

VISUAL PROOF

These tough jobs emphasize the superiority of "AMERICAN" Super-Productive Lathes.

They also turn the spotlight upon the necessity for HARDENED ALLOY STEEL INTERNAL FACE PLATE RING GEARS—ADEQUATE SPINDLE AND SHAFT BEARINGS TO ABSORB THE ENORMOUS BEARING LOADS AND PARTICULARLY UPON THE NECESSITY FOR POWER, STABILITY AND OVER-ALL RUGGEDNESS.

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Bulletin No. 87 gives all the facts.

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Lathes and Radial Drills

CINCINNATI, OHIO, U. S. A.

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Maybe you are unaware of profit leaks creeping into your plant through low production rates and excessive wheel replacements.

A new note of gladness will strike a responsive chord with your cost man when he sees the savings after a shift to job-designed Peninsular grinding wheels.

Peninsular engineers have specialized in such savings since 1889 and are available for a careful study of your grinding operations. They can show the way to substantial cost reductions through a change-over to wheels specially designed for your work. They make a complete analysis of your equipment, of the material to be ground, and of all other important factors that influence costs.

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SINCE 1889

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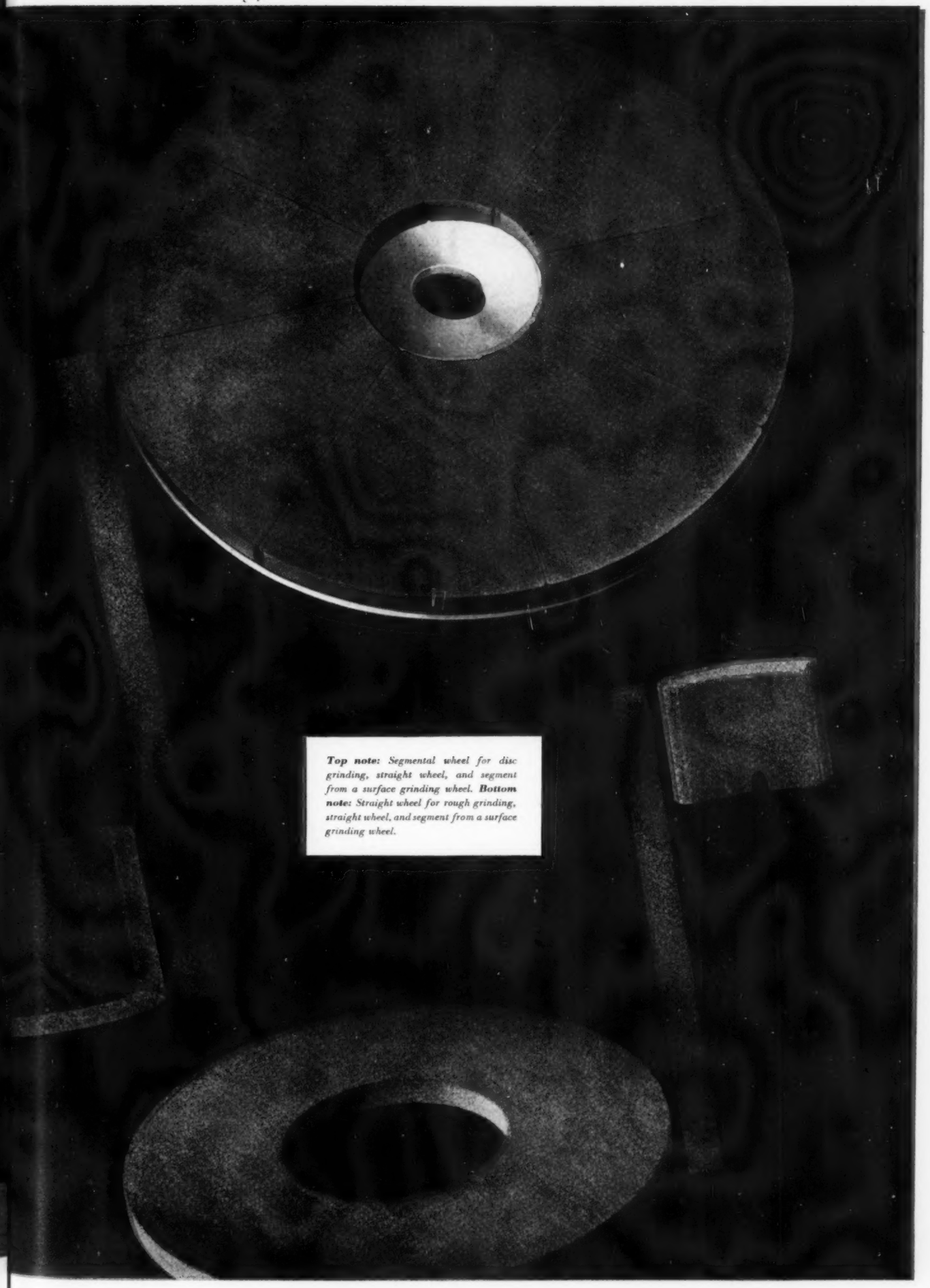

Top note: *Segmental wheel for disc grinding, straight wheel, and segment from a surface grinding wheel.* ***Bottom note:*** *Straight wheel for rough grinding, straight wheel, and segment from a surface grinding wheel.*

Fosdick

HIGH SPEED SENSITIVE DRILLS

are meeting drilling, reaming and tapping demands on holes up to 1½ diameter.

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● For small hole drilling, reaming and tapping of diameters up to 1½ inch, this Fosdick H. S. Drill offers many advantages.

One is that you can get practically anything you want in the way of speeds and number of spindles. Spindle speeds range from 110 to 1800, and machine can be furnished in any number of spindles up to six. Unless otherwise specified, single speed motors with complete controls will be furnished. To provide reverse for tapping an extra contactor is added to the controller.

Operation is simple with controls conveniently located. By moving the hand wheel forward the spindle will feed downward, by reversing the hand wheel the spindle will automatically reverse.

You cannot go wrong with a Fosdick High Speed Drill for your small hole drilling, reaming and tapping operations. *For details, ask for Fosdick Drill Bulletin H.S.A.*

THE Fosdick MACHINE TOOL COMPANY
CINCINNATI 23, OHIO

A Purchasing Agent Writes a Norton Advertisement on 32 ALUNDUM*

Norton Company
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We have recently run some tests with Norton's new 32 ALUNDUM Grinding Wheels and the results obtained were so far ahead of anything we have ever used that it is recommended that the Norton Company send one of their representatives here to make a survey and suggest the proper 32 ALUNDUM Wheel specifications for our surface, tool, and internal grinding operations.

In our judgment these new grinding wheels cut faster, require fewer dressings, and last longer than the wheels we are now using for the majority of our grinding operations.

Therefore, we suggest the above recommended survey and change to this new wheel wherever advisable as soon as possible, keeping in mind the depletion of our present stock so as not to have a quantity of old wheels on hand after the change over.

Very truly yours,

(A Prominent Textile Machinery Manufacturer)

Purchasing Agent

NORTON ABRASIVES

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Longer lasting accuracy and greater all-round efficiency of UNION tools under stepped-up production demands are the direct result of careful selection of materials, close production control through every step in manufacture and developments in tool design which only long, specialized experience can create.

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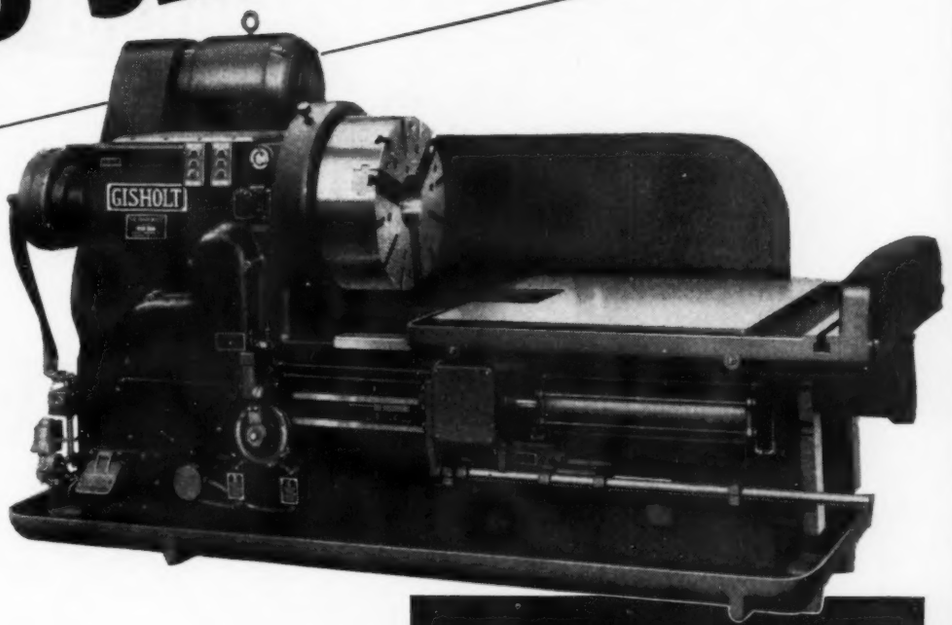


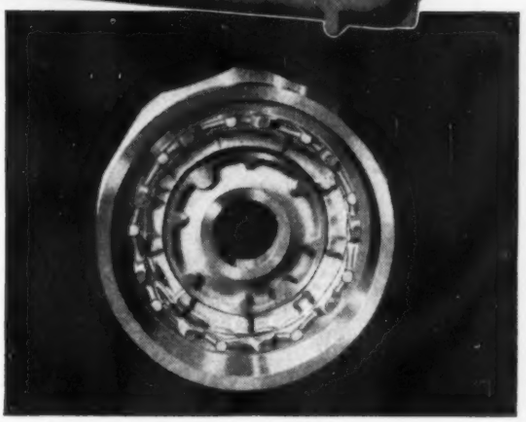
cuts costs on heavy machining jobs

The GISHOLT SIMPLIMATIC

When you put a Simplimatic on the job, you have all the characteristics of an automatic lathe designed solely for that job. Its simple basic design, with the large platen table, permits an endless variety of slide arrangements, assuring the most favorable tooling possible for each job.

Add to this the rugged construction which permits multiple cutting at high speeds, and you have the formula for lower costs on an extremely wide range of heavy turning work. And with completely automatic operation, one man can usually tend two or more machines.

Ask for complete information.



This airplane radial engine crankcase is machined on a Simplimatic. Ten surfaces are machined in 3 minutes and 10 seconds.

Showing arrangement of tooling on Simplimatic for job above. Ten men and ten modern vertical-type turret lathes were formerly required for work now done by one man and two Simplimatics.

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UNBRAKO

THE *Knurling* SAVES TIME

EVEN WITH OILY, GREASY HANDS

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PAT. AND PATS. PEND.

KITS: PATS. PENDING

The "Unbrako" Socket Head Cap Screw is a time-saver because the knurled head provides a slip- and fumble-proof grip—even for the oiliest and greasiest fingers. It can, therefore, be screwed-in faster and farther before it becomes necessary to use a wrench . . . assures a more compact, neater fastening with decided savings in material, space and cost.

Self-Locking "Unbrako" Socket Set Screws—with knurled Cup-Point—hold fast because the knurled point digs in and stays tight, even under the most chattering vibration.

"Unbrako" Socket Set Screws—with knurled threads—are also self-locking. They are for use where the point cannot be knurled. These and the Socket Head Cap Screws are available in sizes #4 to 1½". Write for your copy of our "Unbrako" Screw Products catalog.

Knurling of Socket Screws originated with "Unbrako" in 1934.

You can't screw socket screws in or out without a hex socket wrench—so why not get our No. 25 or No. 50 "Hallowell" Hollow Handle Key Kit which contains most all hex bits.

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ELMIRA, N.Y.

DV59 HIGH SPEED PRECISION LATHE

FEATURES

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- Full Bearing Tailstock Spindle
- 1" Collet Capacity
- 9" Swing
- Speeds to 4000 r.p.m.

HARDINGE BROTHERS, INC.
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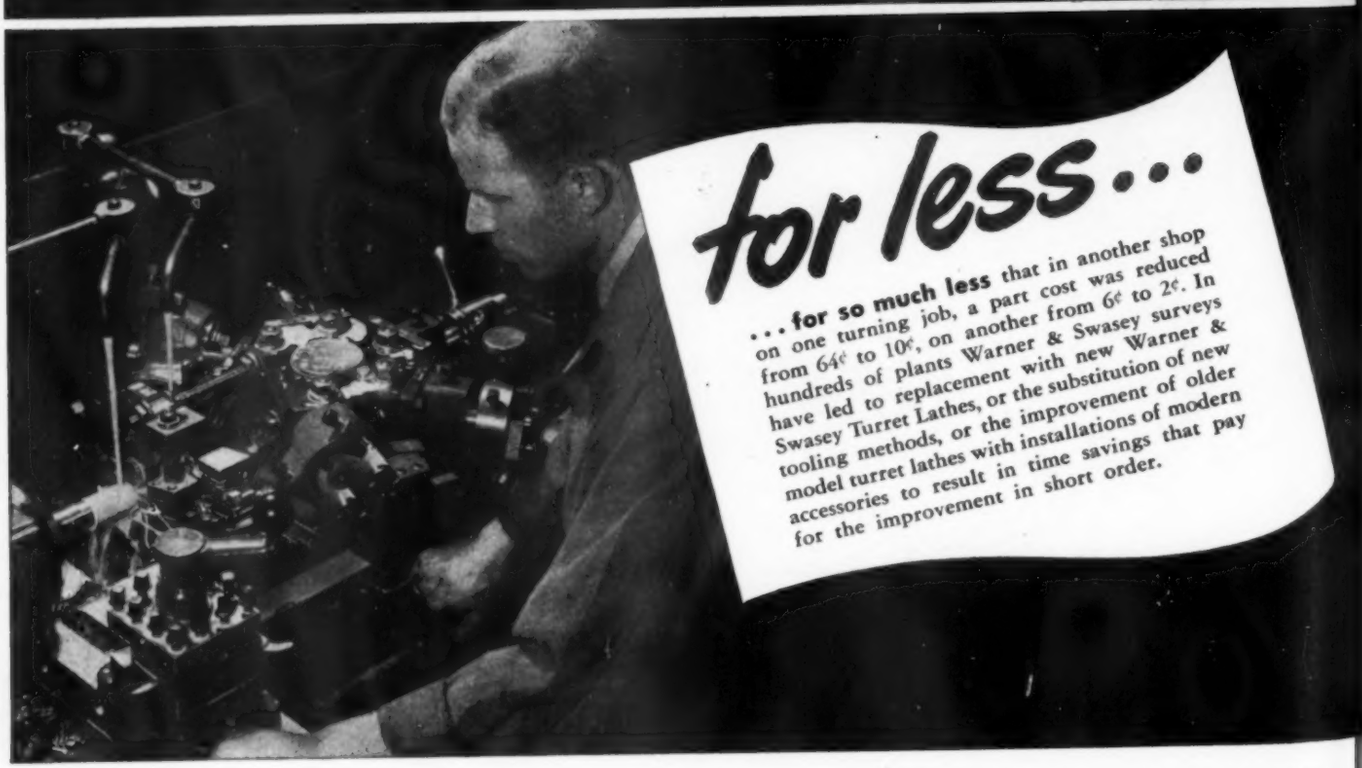
GREATEST ADVANCEMENT IN PRECISION LATHE CONSTRUCTION

You can

better

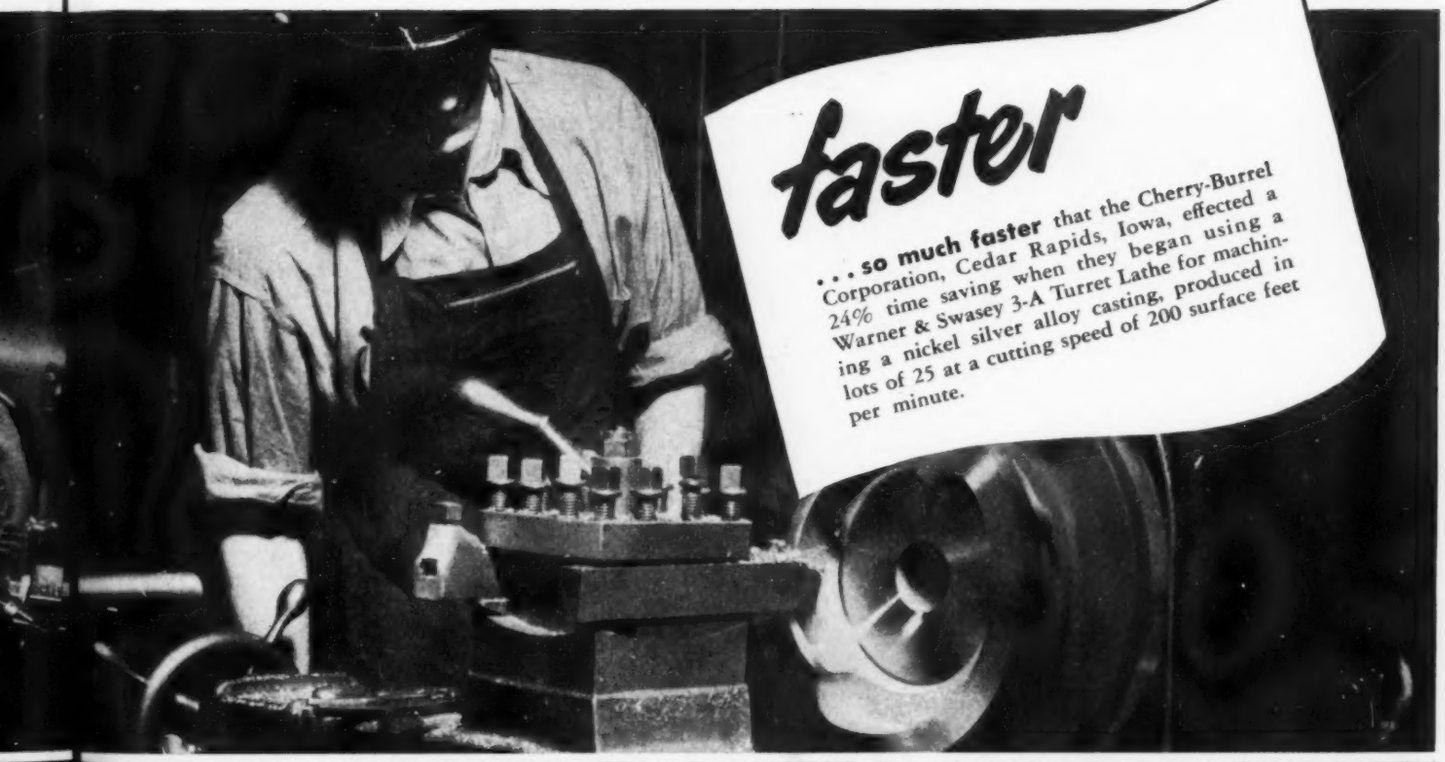
. . . so much better that in the plant of the Hanau Engineering Corporation, Buffalo, a Warner & Swasey Turret Lathe has made average production savings of 26.7%. Scrap loss is held to a minimum. Stainless steel, brass and aluminum parts for scientific instruments are held to close tolerances—turned out with mirror-like finishes.



for less . . .

. . . for so much less that in another shop on one turning job, a part cost was reduced from 64¢ to 10¢, on another from 6¢ to 2¢. In hundreds of plants Warner & Swasey surveys have led to replacement with new Warner & Swasey Turret Lathes, or the substitution of new tooling methods, or the improvement of older model turret lathes with installations of modern accessories to result in time savings that pay for the improvement in short order.

machine it...



faster

...so much faster that the Cherry-Burrel Corporation, Cedar Rapids, Iowa, effected a 24% time saving when they began using a Warner & Swasey 3-A Turret Lathe for machining a nickel silver alloy casting, produced in lots of 25 at a cutting speed of 200 surface feet per minute.

with a Warner & Swasey

Trained Warner & Swasey field engineers will be glad to survey your turret lathe operations, and to show you how you can machine it better, faster, for less with a Warner & Swasey.

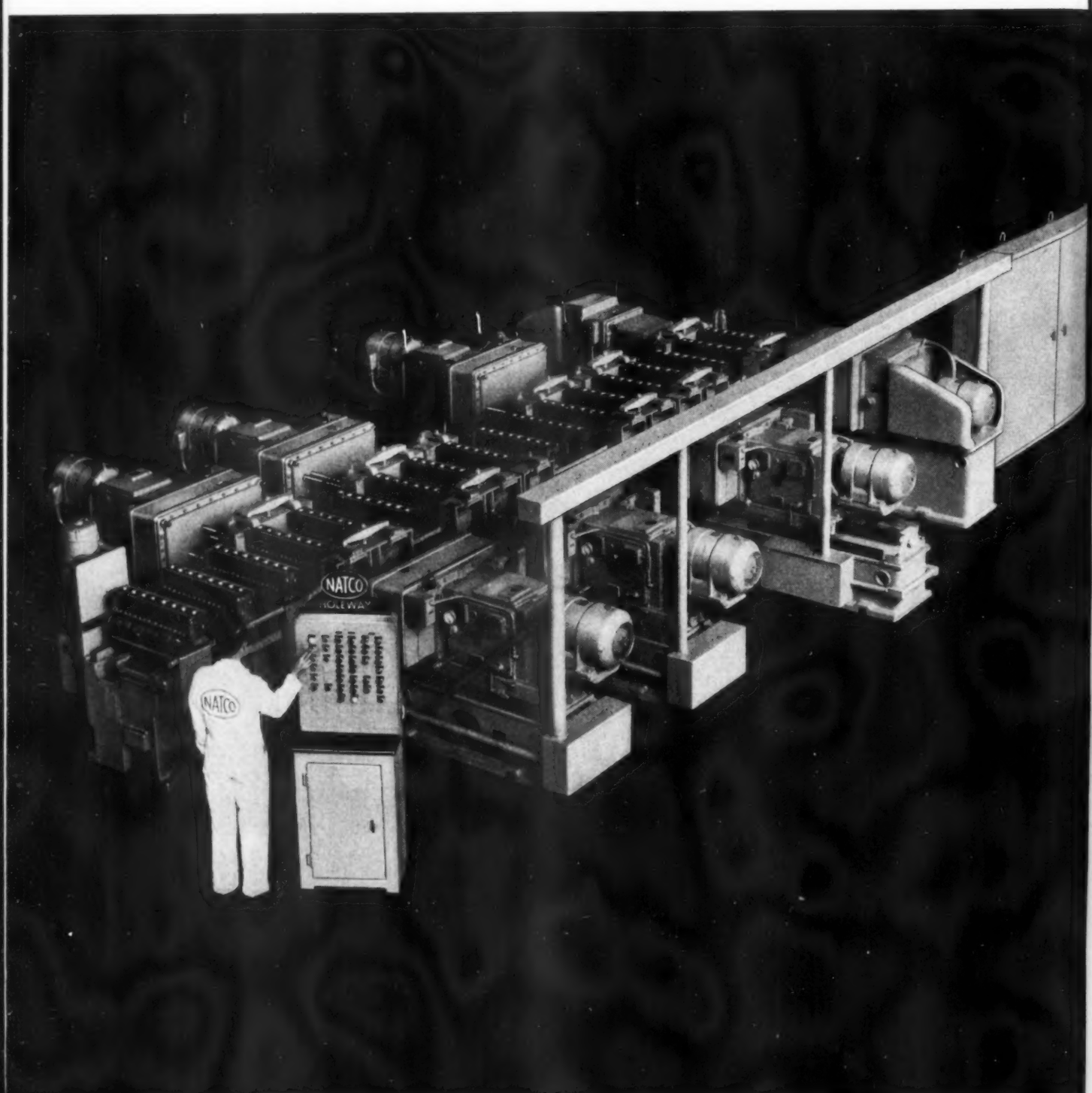
WARNER & SWASEY
Machine Tools
Cleveland

TURRET LATHES, MULTIPLE SPINDLE AUTOMATICS, PRECISION TAPPING AND THREADING MACHINES

NATCO HOLEWAY Processing

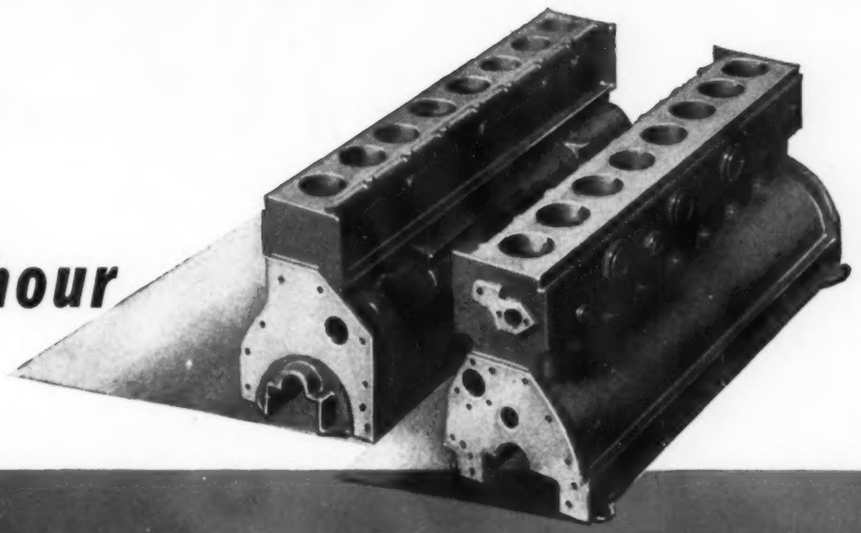
(Automatic Processing)

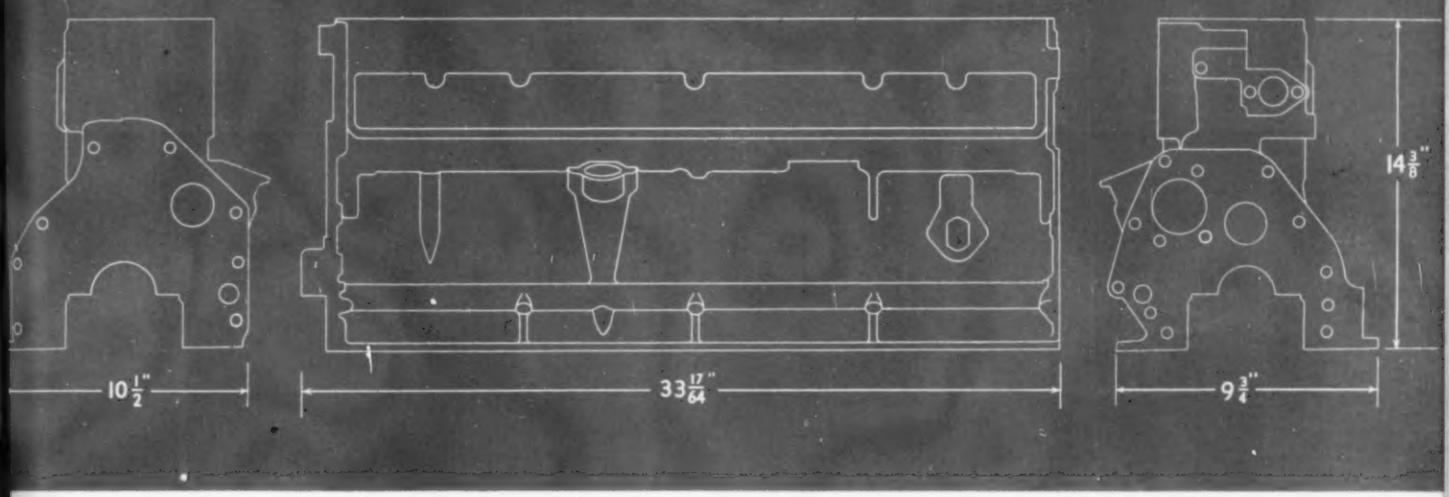
produces 90 engine



ng Machine

ne blocks per hour





The NATCO HOLEWAY Processing Machine illustrated at the left produces 90 engine blocks per hour with only one operator. It automatically advances the engine blocks from station to station, clamps and unclamps them in each position, and synchronously performs the operations at all stations as the blocks travel through the HOLEWAY Machine. The blocks are then automatically ejected onto a roller conveyor at the completion of all operations.

The NATCO HOLEWAY Machine illustrated here involves 19 stations and is arranged to complete the following operations: drills 23 holes ranging from 3/16″ to ½″; combination drills and countersinks one 7/16″ hole; countersinks 14 holes ranging from 3/16″ to ½″; taps 15 holes ranging from ⅜″ to 7/16″ tap; drills 19/32″ diameter oil gallery hole clear through engine block in 12 successive steps; taps oil gallery both ends ⅜″ pipe tap.

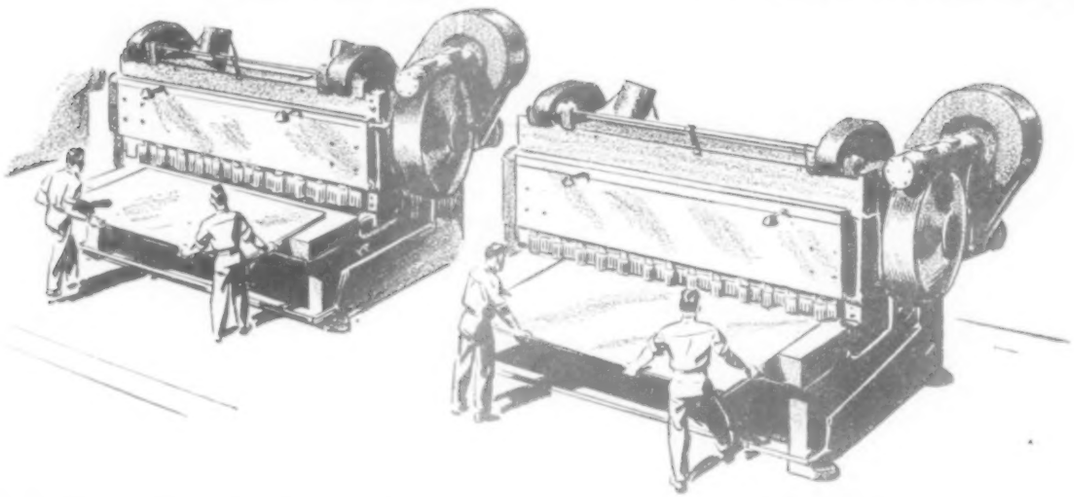
Join the trend to automatic handling . . .

WRITE TODAY For New Illustrated Book!

How NATCO automatic Processing Machines speed productive capacities of both machine and operator is described by actual case studies in a 28-page circular. It will pay you to write for one of these illustrated circulars to see how you can improve your automatic handling methods. Specify NATCO Machine Circular No. 145-A.

NATIONAL AUTOMATIC TOOL COMPANY, INC., RICHMOND, IND., U. S. A. • *Branch Offices:* 1809 Engineering Building, Chicago • 409 New Center Building, Detroit • 1807 Elmwood Avenue, Buffalo • 2902 Commerce Building, New York City

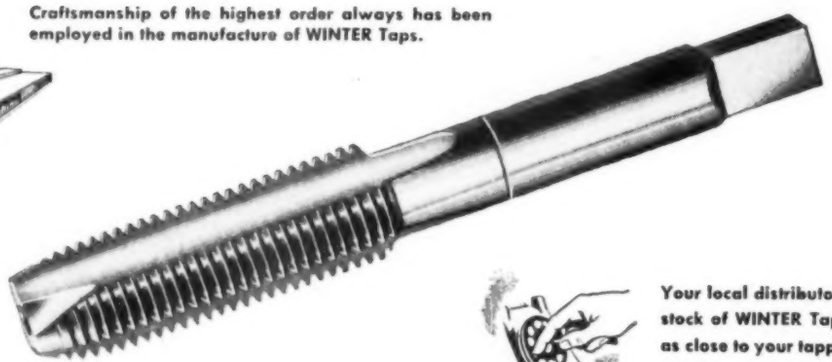
IN HEAVY INDUSTRY...



Leadership BUILDS ON *Craftsmanship*

More than 43 years of engineering development stand behind every WINTER Tap. The WINTER Chip Driver Tap (pictured below) was developed for extremely fast operation in tough alloys. Designed to make a shearing cut which turns the chips ahead of the tap, its productivity far exceeds other types of taps for many applications. The WINTER Chip Driver Tap is one of a complete line of carbon and high speed steel precision-made Taps and Dies.

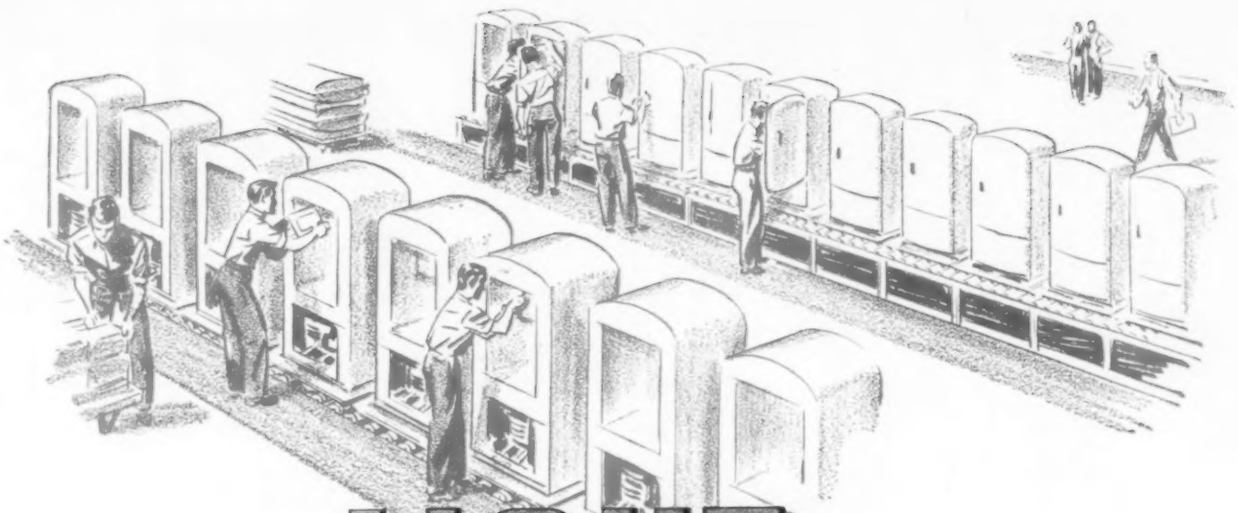
Craftsmanship of the highest order always has been employed in the manufacture of WINTER Taps.



Your local distributor carries a complete stock of WINTER Taps on his shelves—as close to your tapping problems as the phone on your desk.

Winter Brothers COMPANY

WRENTHAM, MASS. and ROCHESTER, MICH. • **Distributors in Principal Cities**
A Division of the National Twist Drill and Tool Company • Branch Stores: San Francisco, Chicago, Detroit

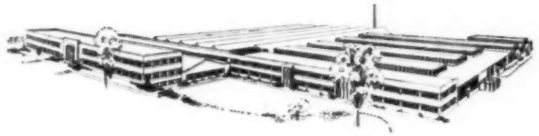


AND IN LIGHT INDUSTRY

NATIONAL Reamers, like all NATIONAL tools, are engineered to give top efficiency in your metal cutting operations. Precise engineering of the proper proportion of lands and flutes, for example, prevents clogging or overheating during reaming operations. By thus eliminating a primary cause of premature dulling, longer tool life is assured. NATIONAL Reamers are part of a complete line of NATIONAL Rotary Metal Cutting Tools in carbon and high speed steel.

Craftsmanship **INSURES** *Quality*

The skill and facilities to make NATIONAL Tools the best you can buy are supplied at NATIONAL'S great new plant in Rochester, Michigan.



Leading distributors everywhere offer complete stocks of NATIONAL Cutting Tools and factory-trained men to serve you. Call them for cutting tools or any staple industrial product.

NATIONAL TWIST DRILL AND TOOL COMPANY

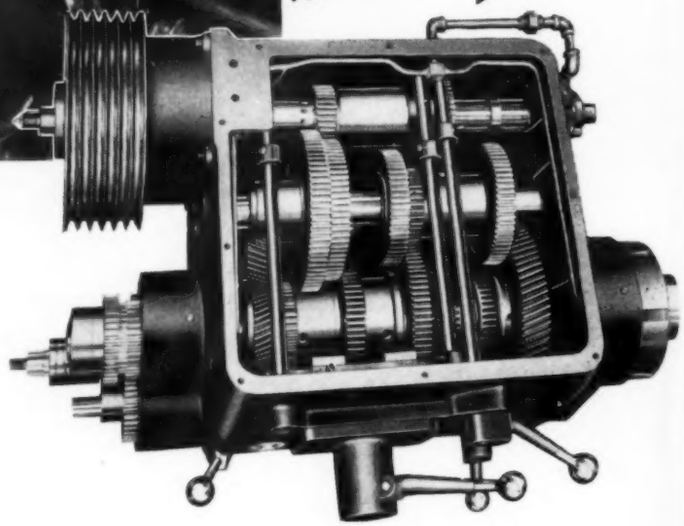
ROCHESTER, MICHIGAN, U.S.A. Distributors in Principal Cities

Factory Branches: New York • Chicago • Detroit • Cleveland • San Francisco

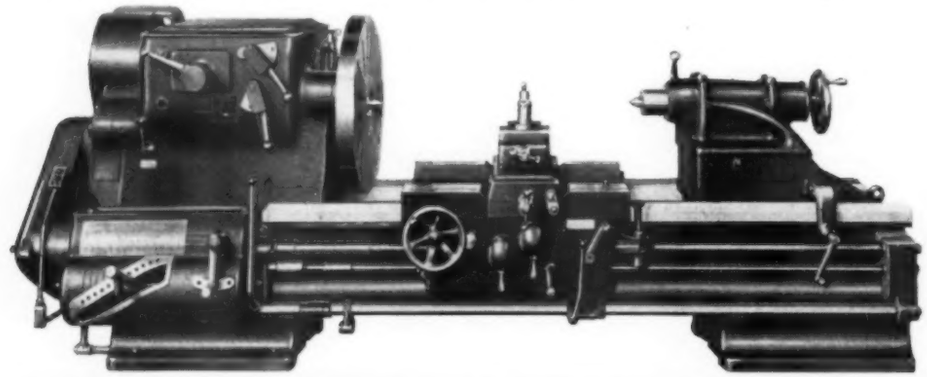
FOR HEAVIER CUTS USE THE

SPRINGFIELD
GEARED HEAD LATHE

It stays in alignment



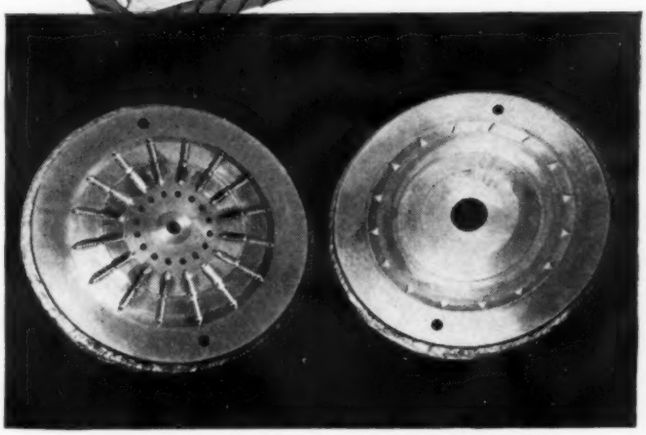
Constant accuracy in hard service is a characteristic of every Springfield Lathe. Construction — extra heavy throughout—reflects a knowledge and practical application of the features that mean profitable lathe operation for you. In the Headstock alone are many factors that contribute to accurate, economical production. A twelve speed spur gear design, the Springfield Headstock uses a helical back gear train and has fourteen large chrome Molybdenum gears with ground teeth. Only seven gears are in mesh at any time—each speed position has a special interlocking device to keep each gear in proper position.



Illustrated bulletins describing Springfield 14" to 30" Lathes will be sent to you on request. Write for them.

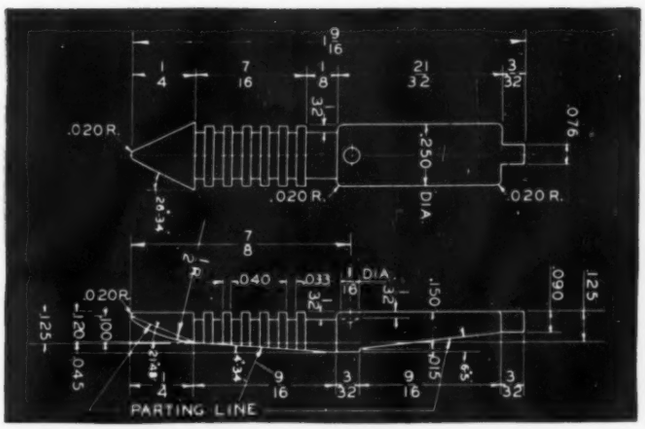
THE SPRINGFIELD MACHINE TOOL CO. • SPRINGFIELD, OHIO

How to Mill an intricate 16-Cavity Injection Mold complete.. *averaging 8¾ hours per cavity!*



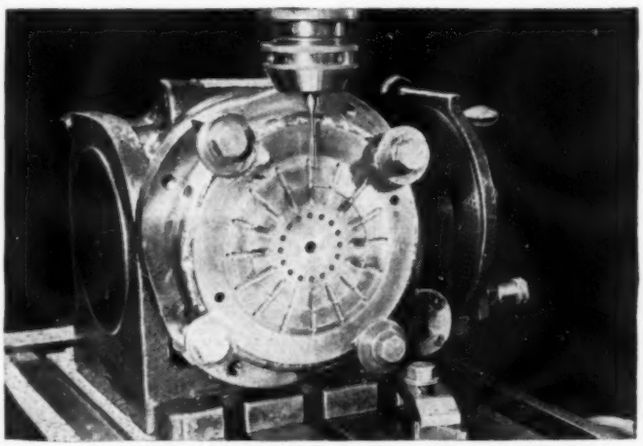
FAST! Both halves of this 16 cavity injection mold for an ink feed part for desk pens milled complete and ejection pin holes spotted in 140 hours! That's typical performance of a Kearney & Trecker — Milwaukee Model 2D Rotary Head Milling Machine on difficult mold making jobs.

1



DIRECT! These multiple contours were transmitted direct from print to mold block. No fussing with templets or models. One cavity accurately located and each operation successively duplicated after indexing on a dividing head. That's the Rotary head method of "multiple origination."

2



ACCURATE! Single setup reduced chance for error. Operator relied on built-in precision control and measuring devices for precise end results. Ejector half tipped 90° and special cutter used to square groove corners.

3

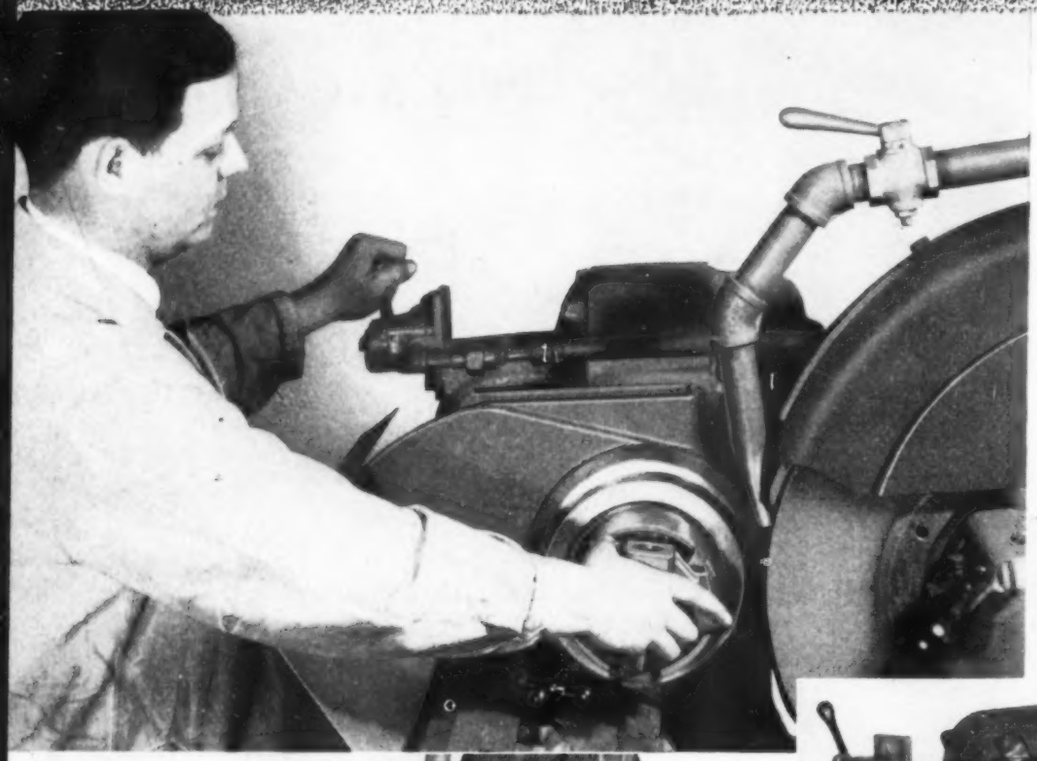
Job Data Courtesy of Senghusch Self Closing Inkstand Company

KEARNEY & TRECKER CORPORATION
MILWAUKEE 14, WISCONSIN 4718

For more facts of how you can get Fast, Direct, Accurate results on other mold, tool, die, pattern, toolroom and general production work, using the Rotary Head Method, write for bulletin 1002C on the Model 2D Rotary Head Milling Machine.

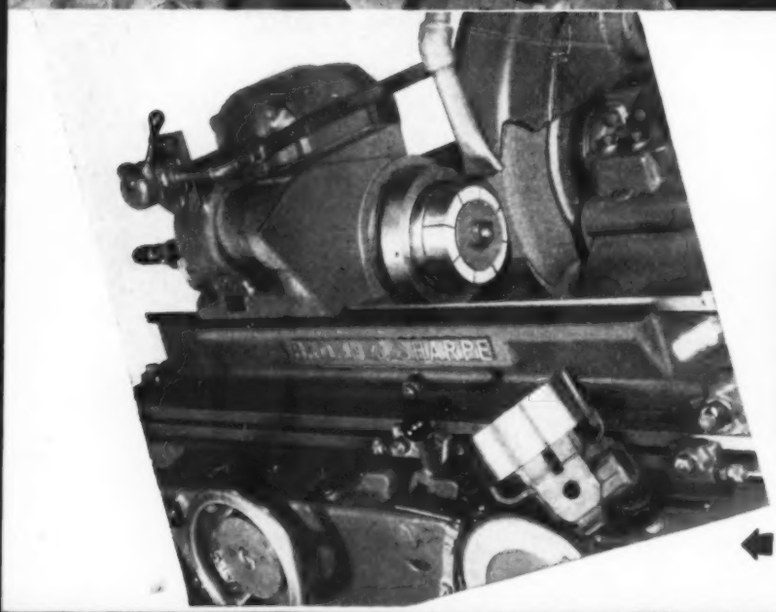
4

Another instance of that simplifies tough jobs.



No complicated fixtures to hold work. The air-operated expanding arbor enables the operator to load and unload quickly.

Straight-in-feed grinding is accomplished with a wide wheel, oscillated by the Wheel Spindle Reciprocating Arrangement. Close-fitting wheel spindle gives fine limits of accuracy, concentricity and micro-inch finish, consistently repeated.



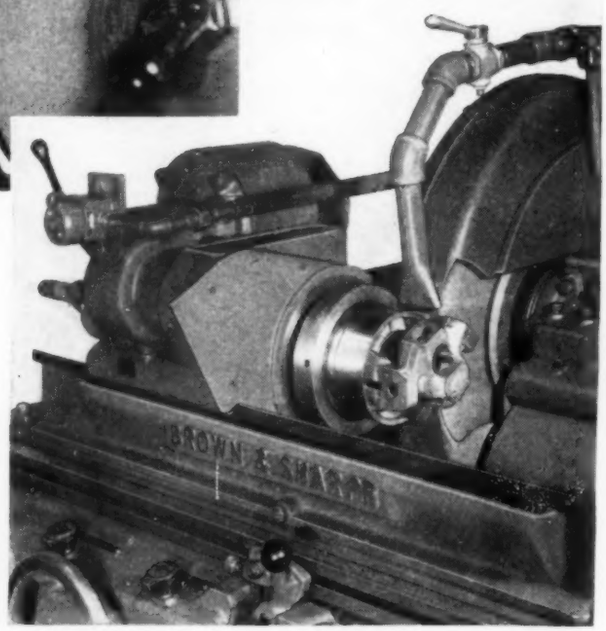
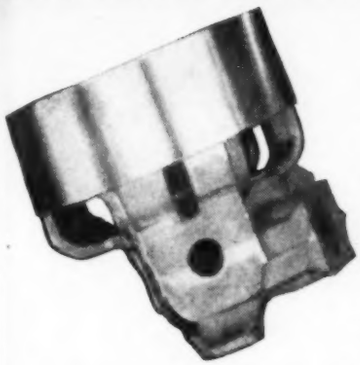


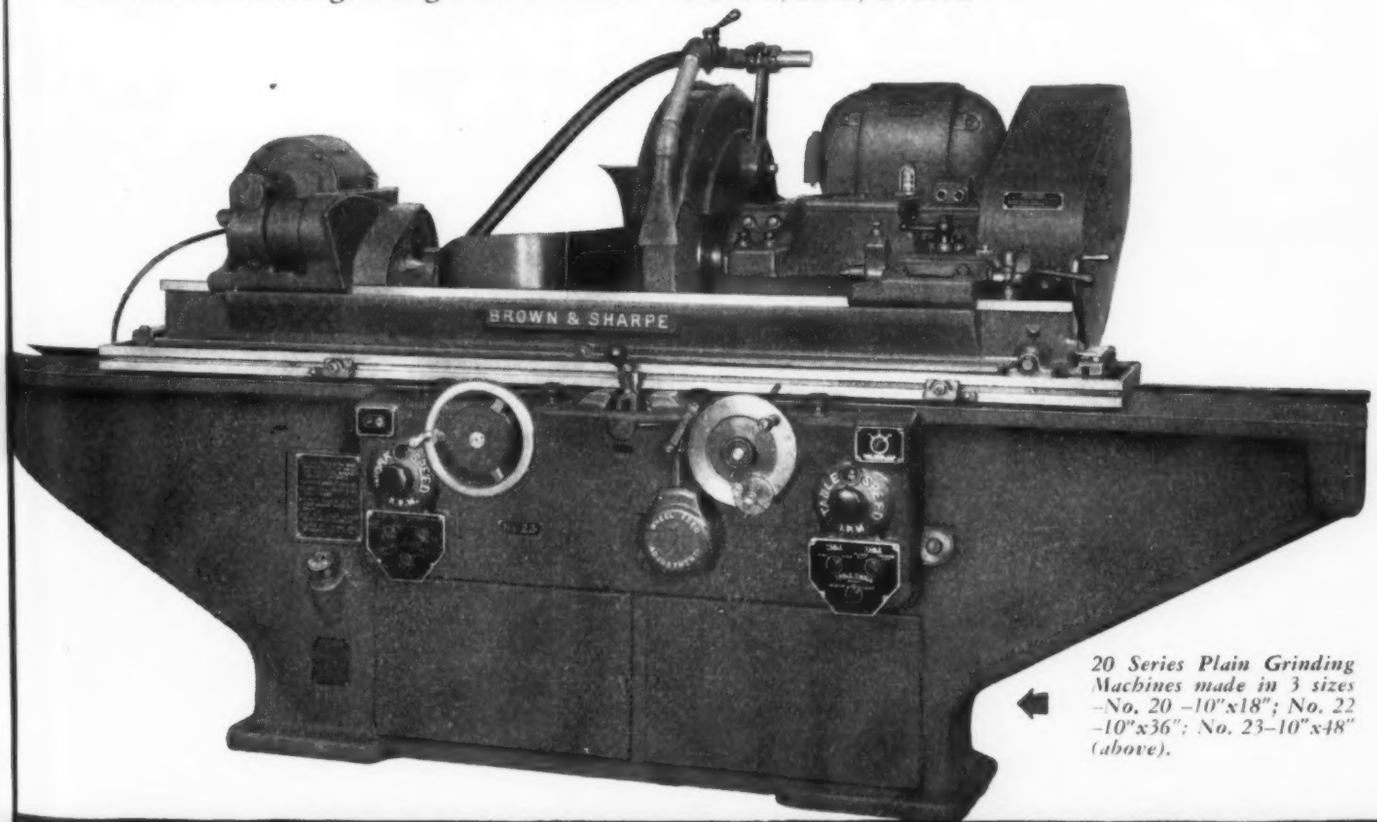
Photo shows construction of the air-operated expanding arbor. Under pressure, the segments of the arbor engage the work from the inside, holding work accurately and securely without danger of distortion.

BROWN &

Brown & Sharpe designing . . . . SPEEDS PRODUCTION



● This cast iron compressor body is ground easily and profitably on a No. 20 Plain Grinding Machine. High production and close accuracy are attained. The air-operated arbor makes a simple operation of work-holding and work-releasing. The great flexibility of the machine itself reduces grinding time to a minimum. Control is semi-automatic by cross feed handwheel which advances wheel to work . . . starting headstock, table, cross feed and coolant . . . and, on completion of automatic cross feed, withdraws wheel and stops headstock, table and coolant. Complete electrical control gives wide facility and ease of operation. Write for detailed, fully illustrated literature on the 20 Series Plain Grinding Machines. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.



20 Series Plain Grinding Machines made in 3 sizes –No. 20 –10"x18"; No. 22 –10"x36"; No. 23–10"x48" (above).

SHARPE

FOR PROFITABLE MASS PRODUCTION

BODY PANELS—125 truck hoods per hour with this 1500 ton H-P-M press, a versatile design for both single and multiple dies.

...OF AUTOMOTIVE PARTS

HPM HYDRAULIC PRESSES

Smooth, shockless power, evenly applied—at mass production speed—that's the key to profitable press work on automotive parts. You can get it with H-P-M Hydraulic Presses. You'll get greater flexibility, too—with closer control and more versatility.

The six operations pictured are typical of a wide variety of automotive work where H-P-M has a proved record of *successful* application. In addition, H-P-M Presses are producing wheels, bumpers, truck running boards, axle and differential housings—and many others, including such specialized parts as bearings. We're ready to put this experience to work for you. Send for an H-P-M engineer and challenge him to show you how hydraulic presses can improve your production. Special orders are routine business for us. May we help you?

Write for your free copy of bulletin 4400. It tells you how high speed press operation is accomplished with the exclusive H-P-M closed circuit.

THE HYDRAULIC PRESS MANUFACTURING CO. Mount Gilead, Ohio, U. S. A.

Branch Offices: New York, Philadelphia, Cincinnati, Cleveland, Detroit and Chicago

Representatives in principal cities

Fastraverse – All-Hydraulic

Metal Working Presses

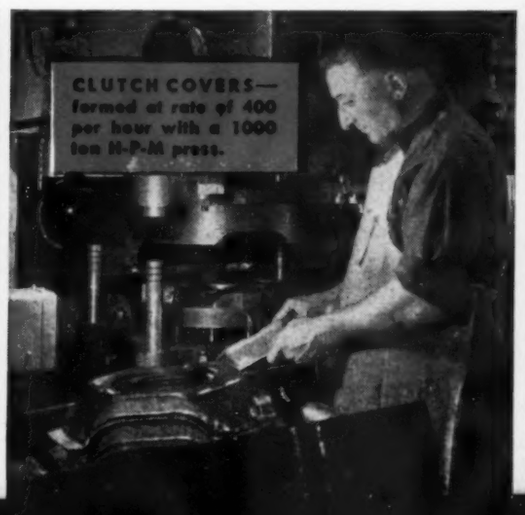
REVOLUTIONIZING PRODUCTION WITH HYDRAULICS SINCE 1877

BRAKE PARTS—drawn and coined at the rate of 300 per hour on a 750 ton H-P-M press with 250 ton die cushion.

OIL PANS—production 250 per hour on this 750 ton H-P-M double-action press.

TRUCK RIMS—formed and sized on a special-design H-P-M truing press.

CRANKSHAFTS—straightening crankshaft forgings on a H-P-M Fastraverse Press.



CLUTCH COVERS—formed at rate of 400 per hour with a 1000 ton H-P-M press.

ANOTHER EXCLUSIVE HYPRO FEATURE

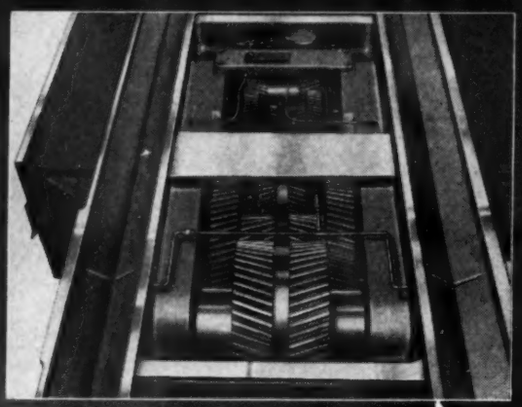
Complete Herringbone Twin Gear Table Drive

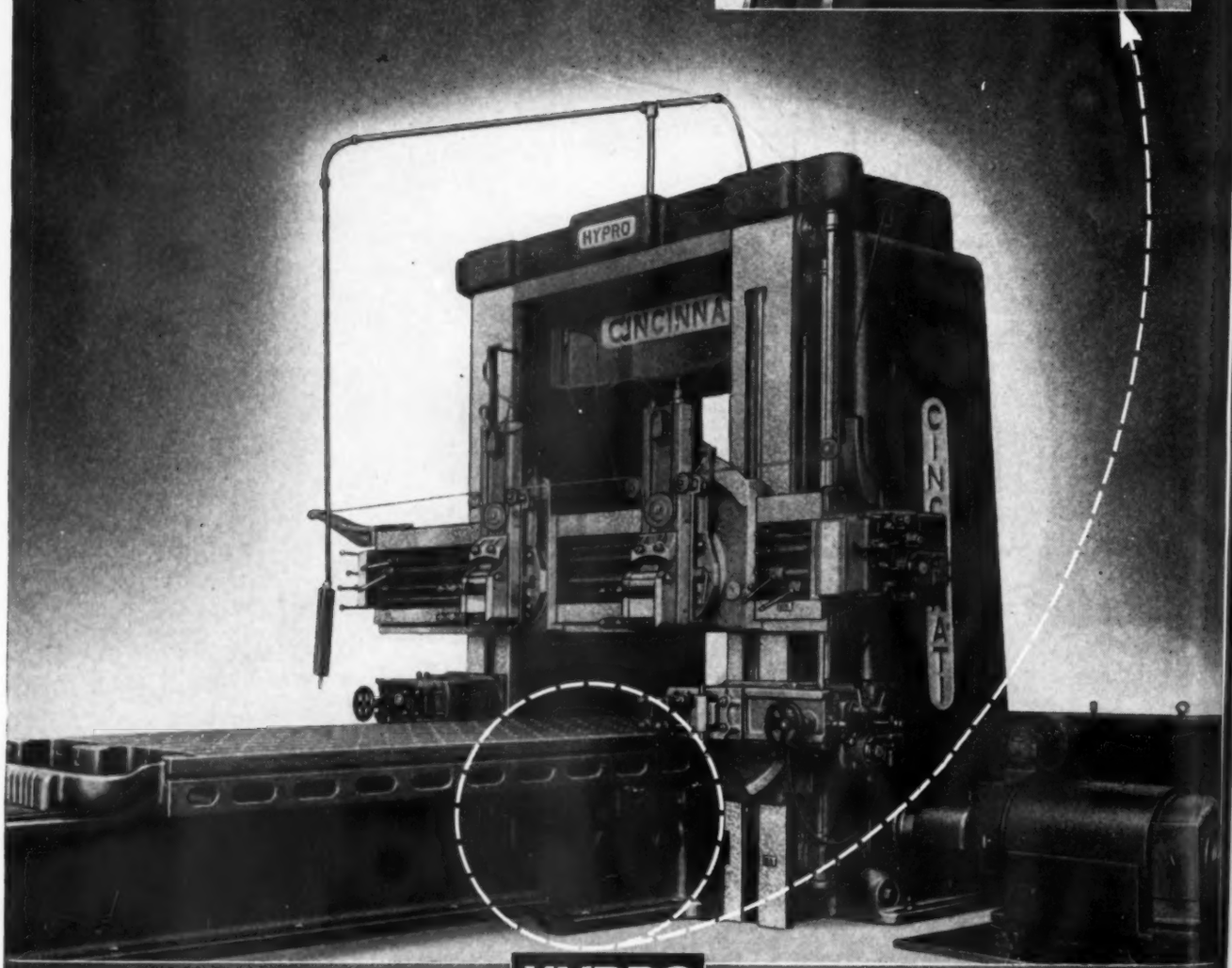
In no other planer will you find the complete steel herringbone twin gear table drive.

The twin gear train, including the bull wheel and rack, is of the herringbone type. This construction gives a smooth, continuous and even flow of power through greater tooth surface and eliminates side thrust.

There is no shock when the load is transferred from tooth to tooth, eliminating practically all wear. The gears work silently and without vibration on their large diameter shafts which are hardened full length and ground at the journals. All gears and pinions are made of steel and flame hardened.

This is one of those exclusive features that make the Cincinnati Hypro a buyer's choice.





THE CINCINNATI HYPRO PLANER COMPANY

PLANERS · BORING MILLS · PLANER TYPE MILLERS

CINCINNATI, OHIO

Sterling

"THE WHEELS OF INDUSTRY"

SNAGGING is a "daily grind" that is made easier and quicker by using Sterling's Vitrified or Resinoid Grinding Wheels, especially developed for the job they are to do. For cool operation and faster metal removal, they are ideal because they are built to job-tested formulas for all types of mills and foundries.

What's your problem—casting cleaning, billet grinding, snagging large or small pieces? Whatever it is, there is a Sterling Grinding Wheel built especially to end your grinding worries.

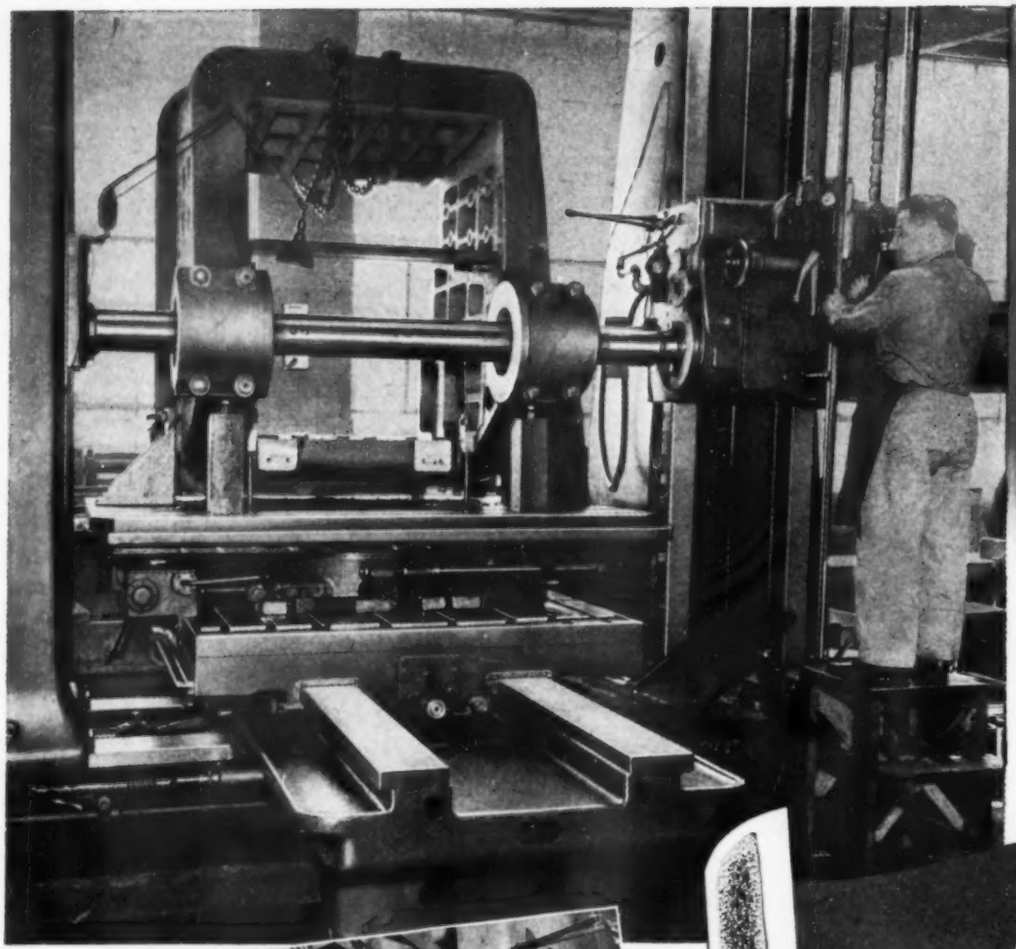
A consultation with a Sterling engineer in your plant . . . right on the job . . . will do much to eliminate trouble-some delays, operator fatigue, and slowed-up schedules. Write today.

The Sterling Specification Selector lists all types of wheels for foundry and steel mill grinding. Send for it now!

• STERLING ABRASIVES •

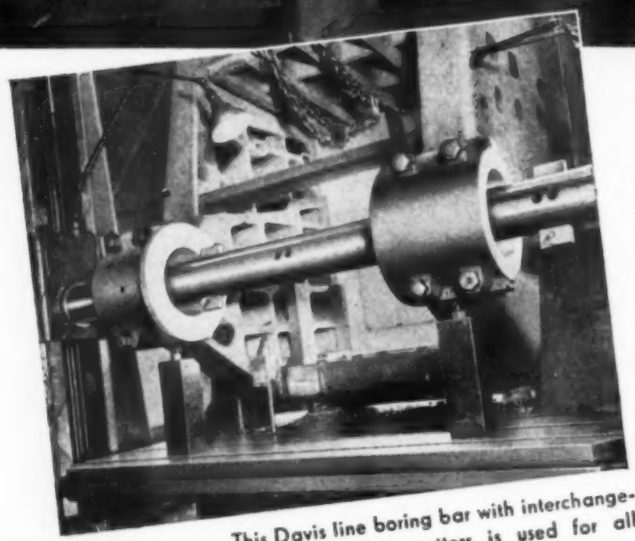
THE STERLING GRINDING WHEEL DIVISION
OF THE CLEVELAND QUARRIES COMPANY
TIFFIN, OHIO

THE WHEELS OF INDUSTRY

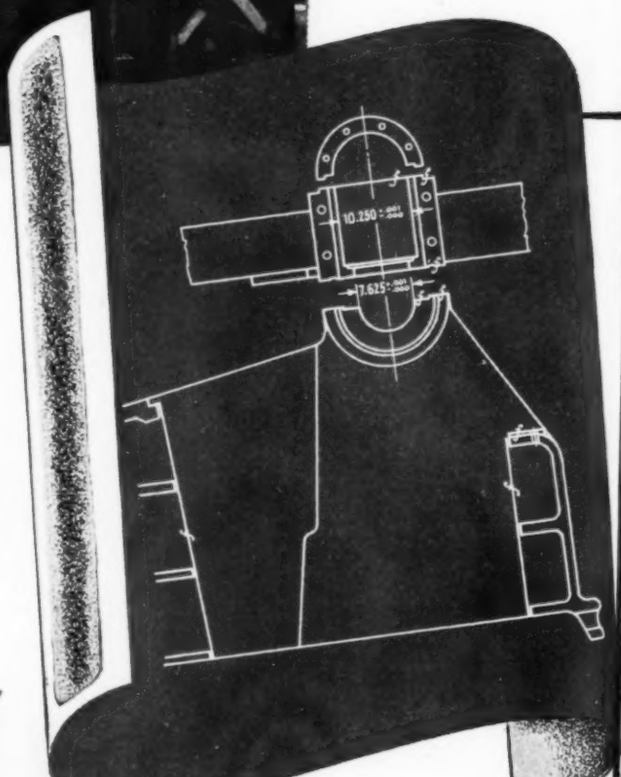


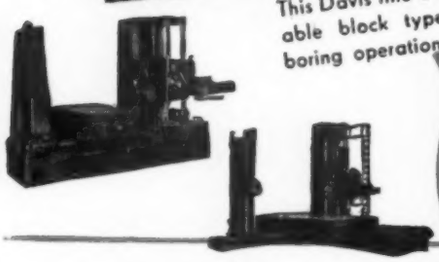
Only

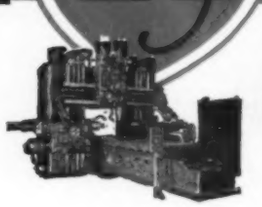
Boring two bearings simultaneously. A.G.&L. rotary table is used to rotate the workpiece and reduce handling time.



This Davis line boring bar with interchangeable block type cutters is used for all boring operations.







Gidding

1 Set-up ON A G.&L. IS REQUIRED TO MACHINE THIS HUGE CASTING

Over-all Machining Time *Cut 51 Hours*... Milling, Facing, Drilling and Tapping Operations are Rapidly Completed as Work is Positioned with Rotary Table

Profitable savings in over-all machining time are effected through single work setups on this G. & L. machine. The huge casting requires numerous boring, drilling, milling, tapping and facing operations. All are easily and readily performed simply by turning the rotary table to correctly position the work. The part itself is not changed from its original setting until the machining work has been completed.

Two bearing bores are made simultaneously and are held to +.001"−.000". A Davis line boring bar with interchangeable block type cutters is used to speed the boring operations. Machining time is cut from 105 to 54 hours.

TYPICAL MACHINING OPERATIONS PERFORMED

Mill bearing cap seats.
Drill 8—1 3/32 holes 2 5/8" deep.
Tap 8—1 1/4" 7 NC-2 stud holes.
Mill 6—1/4" pad—drill and tap pad holes.
Assemble caps.
Index 90° mount line bar and face inner and outer surface.
Bore 2—10.250" bearing holes simultaneously.
Bore 2—7.625" holes simultaneously.
Chamfer.
Drill 8—1 9/16" holes.
Tap 8—5/8" 13 NF-2.
Remove boring bar. Use angular milling attachment to face internal slides and pads.

utline drawing of large crusher base showing a few of the achining operations performed. Only one work setup is needed r the machining shown.

How to Eliminate Excessive Work Handling

Numerous Giddings & Lewis accessories and attachments used separately or in combination often reduce work settings to a minimum. A rotary table, a continuous feed facing head, or an angular milling attachment may easily make it possible for you to produce more work on your G. & L. in less time. Let experienced Giddings & Lewis engineers help you analyze your machining problems and then recommend profit producing equipment to suit your needs.

Photographs courtesy of Universal Engineering Corp., Cedar Rapids, Iowa.

You will want—the new **FREE** Giddings & Lewis Production Data Folder describing outstanding machining methods used by progressive manufacturers. Ask for Production Data Folder AM-27.

s & Lewis MACHINE TOOL CO.

138 DOTY STREET • FOND DU LAC, WISCONSIN

THE HOLE STORY . . . *fast*

The new No. 212 Bryant Automatic Internal Grinder *roughs* and *trues* and *finishes* and *stops* automatically. It requires a minimum of operator attention. It has 9″ maximum swing — 3″ grinding traverse — 12″ total wheel traverse.

The wheelhead shown is the Bryant Hi-Frequency direct drive motor built to operate at speeds up to 100,000 R.P.M. The wheelhead is carried on a hardened and ground cylindrical slide.

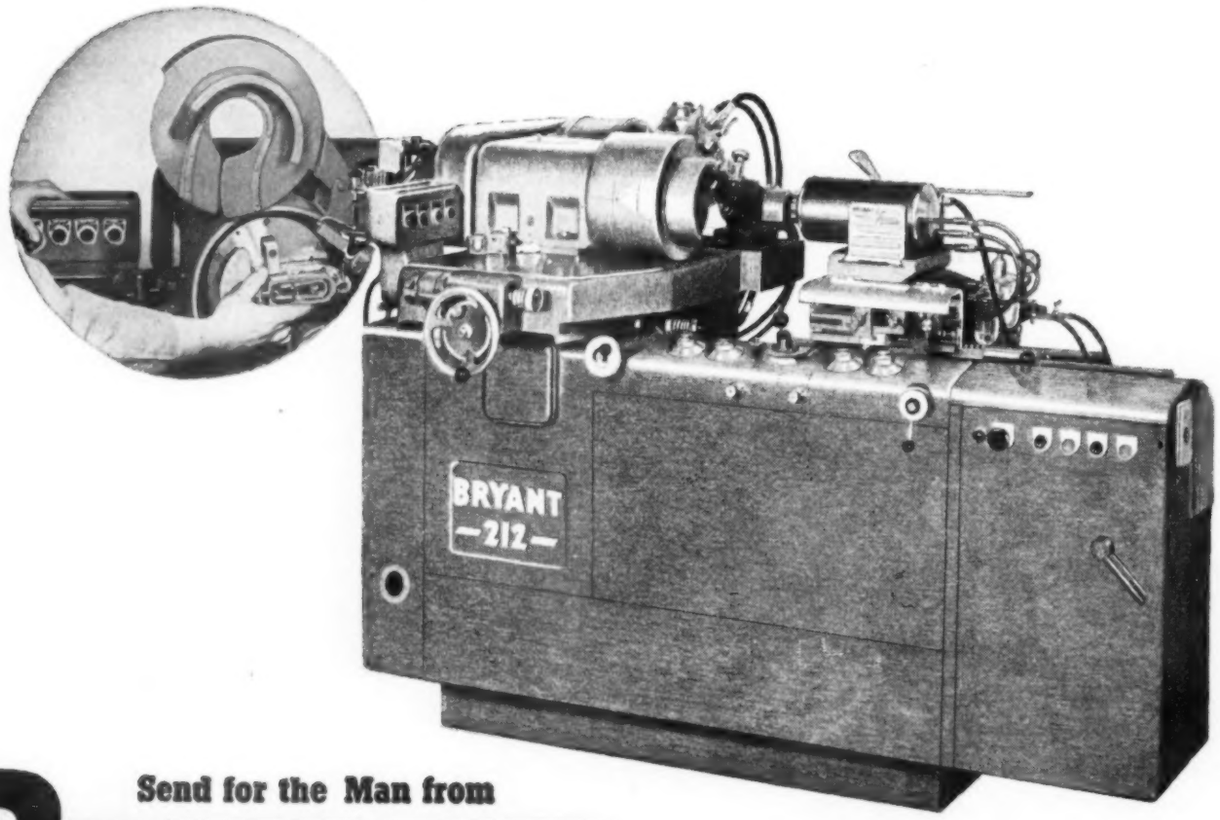
The cross-feed is in the work table which rides on anti-friction bearings and is controlled by a precision lead screw. The work spindle is mounted in preloaded ball bearings and is dynamically balanced to assure precision work.

An electrically controlled hydraulic system provides smooth operation and simple cycle change.

Automatic work sizing is accomplished by any of three methods: by a plug gage mounted in the work spindle; by a diamond contacting the bore; by the wheel trueing diamond.

Operator attention is further minimized by such features as convenient grouping of simplified controls and automatic pressure lubrication.

For a better product and a better profit, ask for further information on the Bryant No. 212 Automatic.

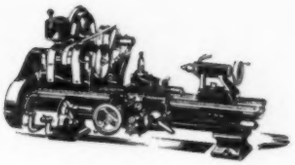


Send for the Man from

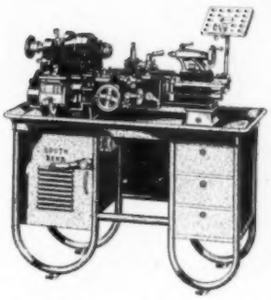
BRYANT

BRYANT CHUCKING GRINDER CO.

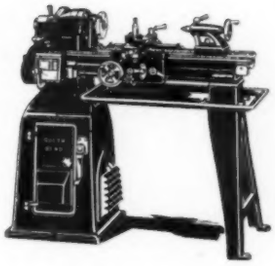
SPRINGFIELD, VERMONT, U. S. A.



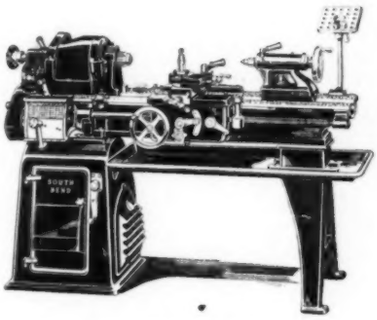
9" Bench Lathe



10" Bench Lathe

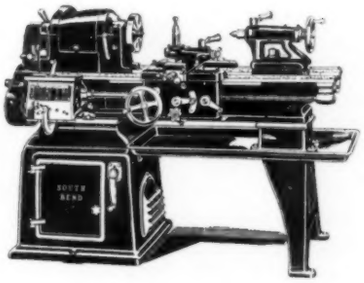


10" Engine Lathe

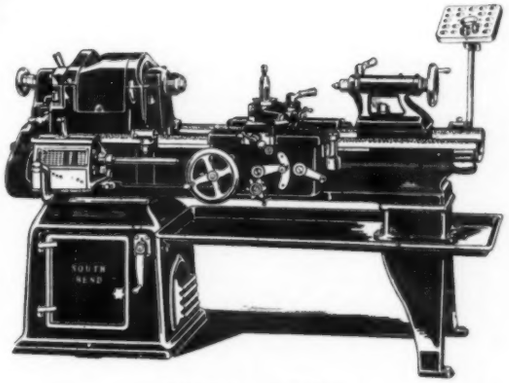


13" Toolroom Lathe

SOUTH BEND LATHES for accurate production operations and exacting toolroom work. Engine Lathes and Toolroom Lathes with 9", 10", 13", 14½", and 16" swings. Precision Turret Lathes with ½" and 1" collet capacities. Write for Catalog 100-F.



14½" Engine Lathe



16" Toolroom Lathe

SOUTH BEND LATHE WORKS

LATHE BUILDERS SINCE 1906 • 419 EAST MADISON STREET, SOUTH BEND 22, INDIANA

Easy-Mounting, Fast-Locking Sheave

Pays Off

The First Time You Put It On!

"MAGIC-GRIP" *sheaves offer time-saving, money-saving features!*

EVEN if you install the sheave only once, and never change it again — it pays to get a "Magic Grip" sheave! For frequent changes, naturally, your savings pyramid.

- No filing or reaming. "Magic-Grip" bushing slides easily, even on oversize shafts.
- No hammering or forcing to damage motor bearings.
- No wheel puller needed to get the sheave off.
- No set screws to mar or score the shaft.
- No wobble or blacklash. "Magic-Grip" sheaves lock to shaft with shrunk-on grip.

HOW DOES IT WORK? Sheave and bushing come completely assembled. You just slip it on the shaft — align — and tighten three screws. *That's all!* And it comes off just as easily.

Standardize on time-saving, money-saving "Magic-Grip" sheaves. They're heavy duty, precision made and finely finished — the best sheaves you can buy . . . the best economy in the long run. Get them through your nearest A-C dealer or office.

ALLIS-CHALMERS, MILWAUKEE 1, WIS.

A 2166

TEXROPE .. Greatest Name in V-Belt Drives

"Super 7" V-BELTS
Five Types — Sizes to suit every power transmission job.

Texsteel, Texdrive, "Magic-Grip"
— sheaves in a full range of sizes, grooves.

"Vari-Pitch" SHEAVES
Exact variations in speed, stationery or motion control.

SPEED CHANGERS
Speed variations up to 375% at the turn of a crank.

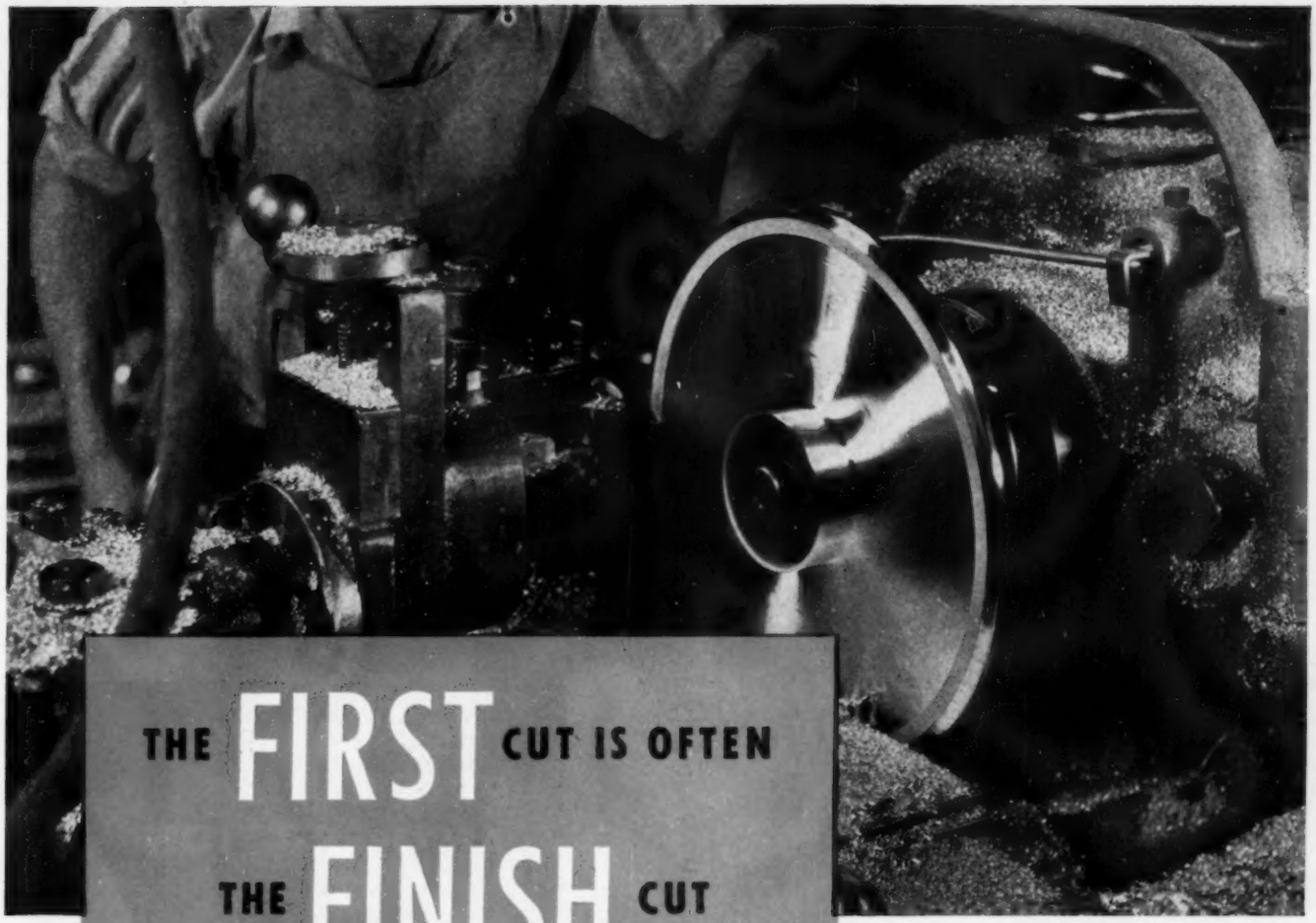
ENGINEERING
Finest V-Belt engineering talent in the world—at your call.

TEXROPE "Super 7" V-Belts result from the cooperative research of two great companies — Allis-Chalmers and B. F. Goodrich. They are sold only by A-C.

ALLIS·CHALMERS

One of the Big 3 in Electric Power Equipment — Biggest of All in Range of Industrial Products

1847 1947
A CENTURY OF SERVICE to Industry THAT MADE America Great



THE FIRST CUT IS OFTEN THE FINISH CUT

WITH A BONUS IN LIGHTNESS

If you're accustomed to a roughing cut, finish cut and finish grinding needed to bring many metal parts to proper standards of finish and tolerance, American Magnesium has a big plus to offer you.

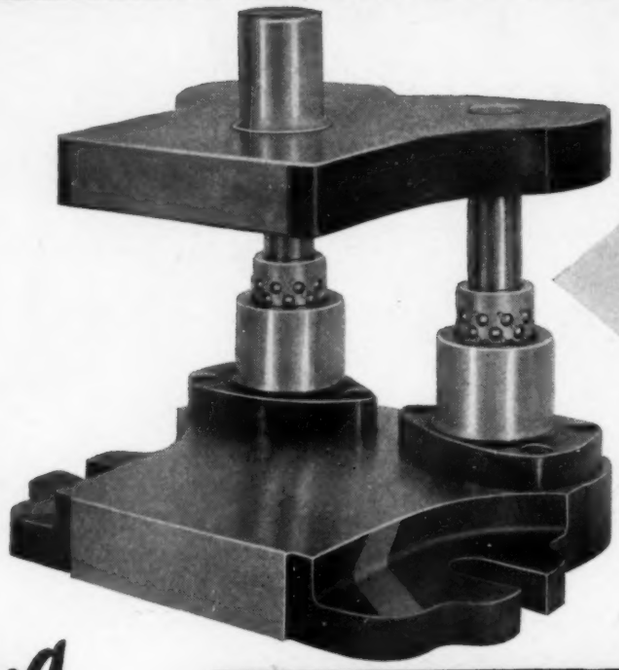
On a permanent-mold casting of American Magnesium, for example, the first cut is often the finish cut. The close limits to which the casting is made, the free machining characteristic of the metal itself, and the high machine speed mean one cut from the cast surface to the final finish. In addition, your product enjoys a bonus in lightness, for American Magnesium is 35% lighter than aluminum, 75% lighter than steel.

And when you specify American Magnesium, you gain the advantage of Aluminum Company of America's 59 years of light-metal know-how to help you apply magnesium where it should be used. Call your nearest Alcoa sales office, or write Aluminum Company of America, sales agent for American Magnesium products, 1709 Gulf Building, Pittsburgh 19, Pennsylvania.

MAGNESIUM MAZLO Reg. U.S. Pat. Off. PRODUCTS

AMERICAN MAGNESIUM CORPORATION

SUBSIDIARY OF ALUMINUM COMPANY OF AMERICA



It's New.. Free-Operating ...Accurate!

IT'S A LEMPCO PRECISION ANTI-FRICTION DIE SET

SQUARE PIN ROLLER BEARING

ROUND PIN BALL BEARING

FOR increased die life . . . faster production . . . greater economy . . . put Lempco Anti-Friction Die Sets to work for you.

Lempco Die Sets are equipped with ball or roller bearing guide pins. As a result, dies can be set up by hand without the use of hammers, mauls, jacks or pry bars. This eliminates production delays caused by accidents to dies and punches . . . saves up to 60% in matching up and assembly time . . . means extra profit for you.

Lempco Anti-Friction Die Sets have been run over long periods on a conventional press as well as on special high speed presses. To assure positive accuracy, bearings have pre-load of .0015". All surfaces including extremely long bosses are ground to exceptionally close tolerance.

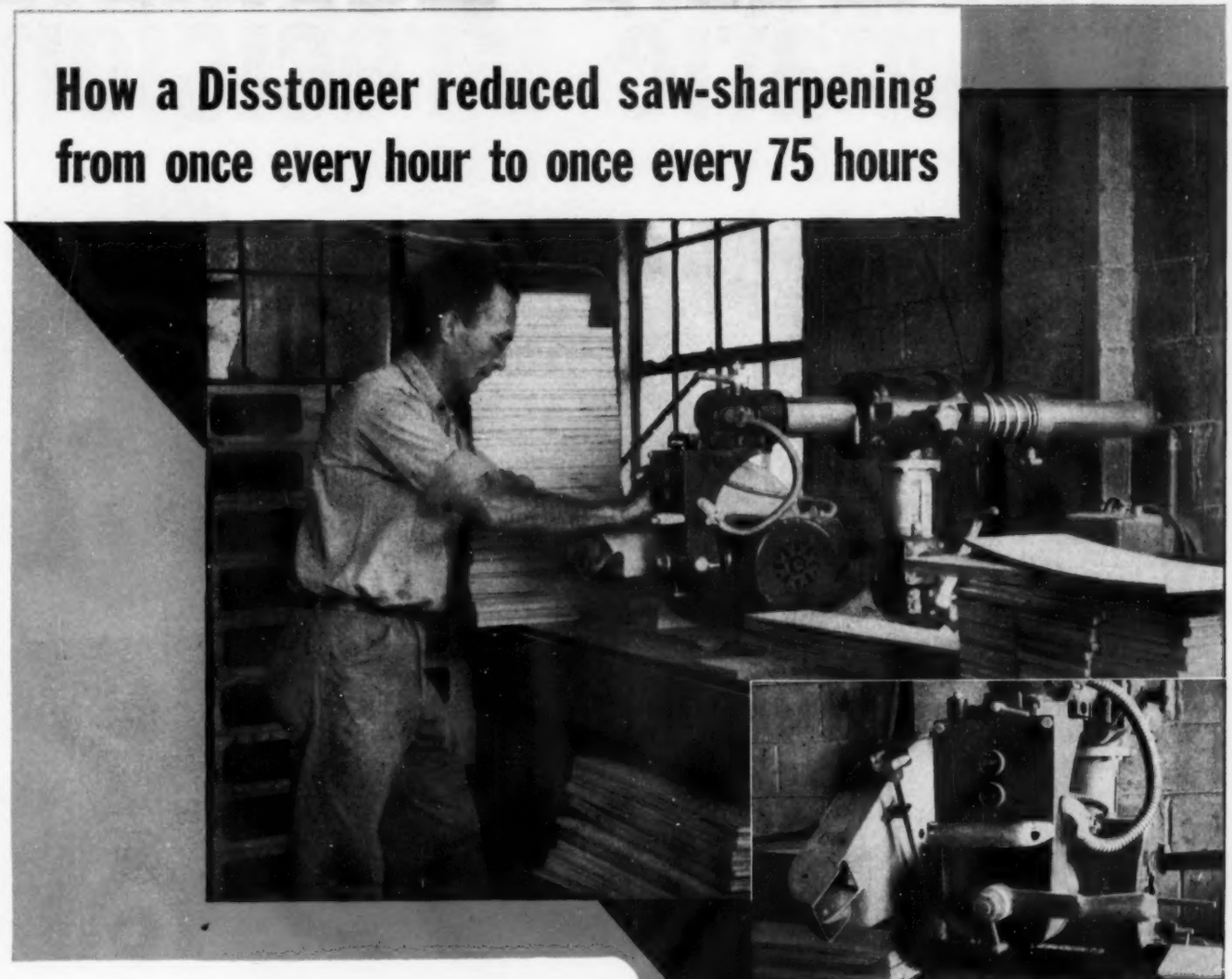
Place your order today and make sure you cash in on all the money-saving features offered by Lempco Precision Anti-Friction Die Sets.

LEMPCO

5711 DUNHAM ROAD
BEDFORD, OHIO, U.S.A.

● *Write for "Facts About Lempco Precision Anti-Friction Die Sets." It's a fully illustrated catalog which lists all the advantages Lempco Die Sets have for you.*

How a Disstoneer reduced saw-sharpening from once every hour to once every 75 hours



It was in the plant of Allwoods, Inc., Toledo, Ohio, where plywood of various kinds and thicknesses is cut in shapes for radio cabinets, toys and other products. The company had been using a combination circular saw which required resharpening every 1 to 1½ hours, with a down time of 5 to 10 minutes. Even after resharpening, the saw would cut rough after the first few cuts and considerable sanding was necessary.

The Disstoneer* who studied the problem recommended a Disston Inserted-section Carboloy-fitted Saw with alternate beveled teeth. After 75 hours of use, without resharpening, the Carboloy-fitted saw cut as smoothly and easily as when first placed on the machine. Cutting was faster, sanding costs reduced, results more uniform and production increased.

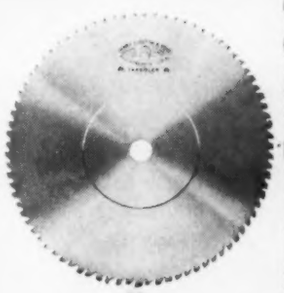
One company executive stated that in all his experience with cutting tools, this saw was the only tool he ever bought that out-performed the manufacturer's claims and surpassed his own most optimistic expectations.

STEEL . . . Everybody who wants to obtain steel, can help himself to get it by immediately starting scrap into the channels that serve steel mills.

*DISSTONEER—a man who combines the experience of Disston leadership and sound engineering knowledge, to find the *right tool* for you—to cut wood, to cut metal and other materials—and TO CUT YOUR COST OF PRODUCTION—*not only on special work, but on ordinary jobs as well.*

DISSTON INSERTED SECTION CARBOLOY FITTED SAW

Used in many manufacturing plants for sawing plywood, asbestos pipe covering, aluminum, cardboard, laminated phenol resinoid products, many others. Teeth are held firmly in place, eliminating up and down or lateral movement. Large open gullets allow free discharge of sawdust, reducing friction and permitting faster feed.



HENRY DISSTON & SONS, INC., 120 Tacony, Philadelphia 35, Pa., U.S.A.

Automatic Precision

. . . beyond human skill with push-button control

The Model 3-B JIGMIL

PROVIDES accuracy beyond human skill by push button control.

Automatic positioning between holes is controlled to within less than one ten-thousandth part of an inch.

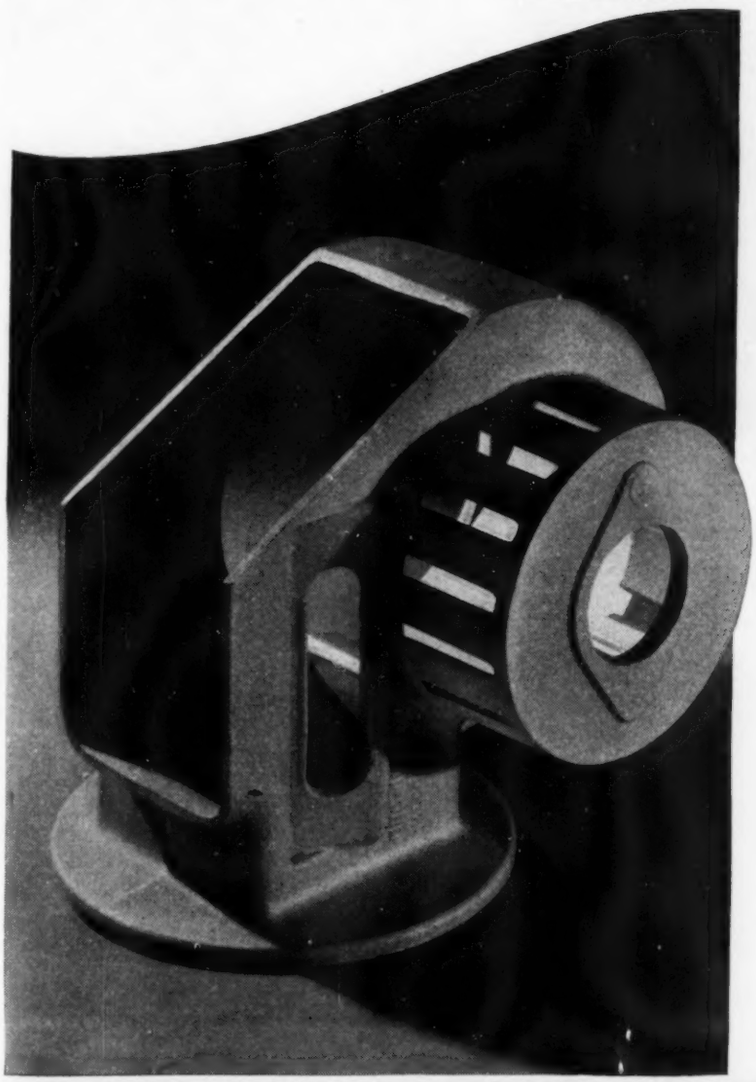
Retraction and repositioning of the work for measuring or tool changing is by push button operation.

Any function is responsive to this centralized finger tip control.

The World's Finest BORING and Milling Machine

DeVLIEG MACHINE COMPANY DEVLIEG JIGMIL **450 FAIR AVE. FERNDALE 20, (Detroit) MICH.**

The changes didn't amount to THAT!



But what a difference they made in cost and delivery time!

Designed originally to be made as an aluminum sand casting, this York-Heat oil burner blower housing is now being produced by the permanent mold process. Production goes faster, costs are reduced. Less finishing is required on the cored openings.

Only minor design alterations were required to make the change. And the manufacturer consulted Alcoa castings experts for advice and suggestions on redesigning the product for maximum benefit from the switch.

As your sales increase on a product you are now making of aluminum sand castings, you will save money by switching to permanent mold castings. The Alcoa experts will analyze your castings and sales to find out whether the change-over point has been reached. And they'll help you make that change-over. ALUMINUM COMPANY OF AMERICA, 2107 Gulf Bldg., Pittsburgh 19, Pennsylvania. Sales offices in leading cities.

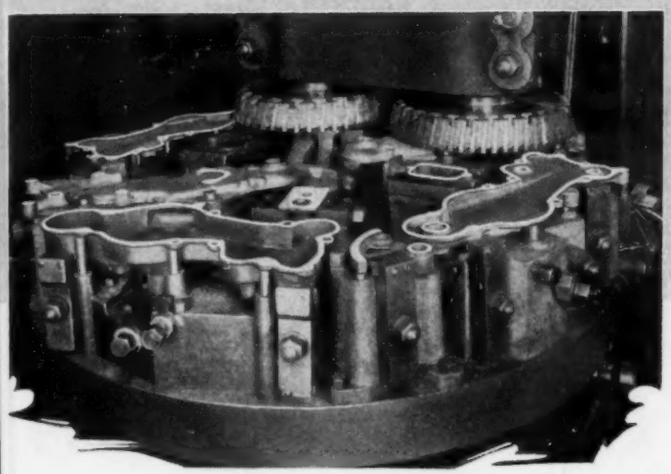
MORE people want
MORE aluminum for
MORE uses than ever

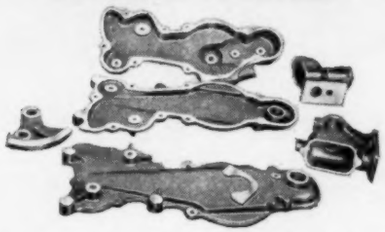
ALCOA ALUMINUM

IN EVERY COMMERCIAL FORM

These BAY STATE abrasive products, manufactured with large pore spaces are especially suitable for SURFACING and TOOL and CUTTER jobs that require extra coolness of cut and heavy, fast removal of metal.
Our sales and distributor representation is located in nearly every principal city. Let them, and us, solve your grinding problems.
BAY STATE
Top Performance Consistently Duplicated
BAY STATE ABRASIVE PRODUCTS CO. • WESTBORO, MASSACHUSETTS, U.S.A.

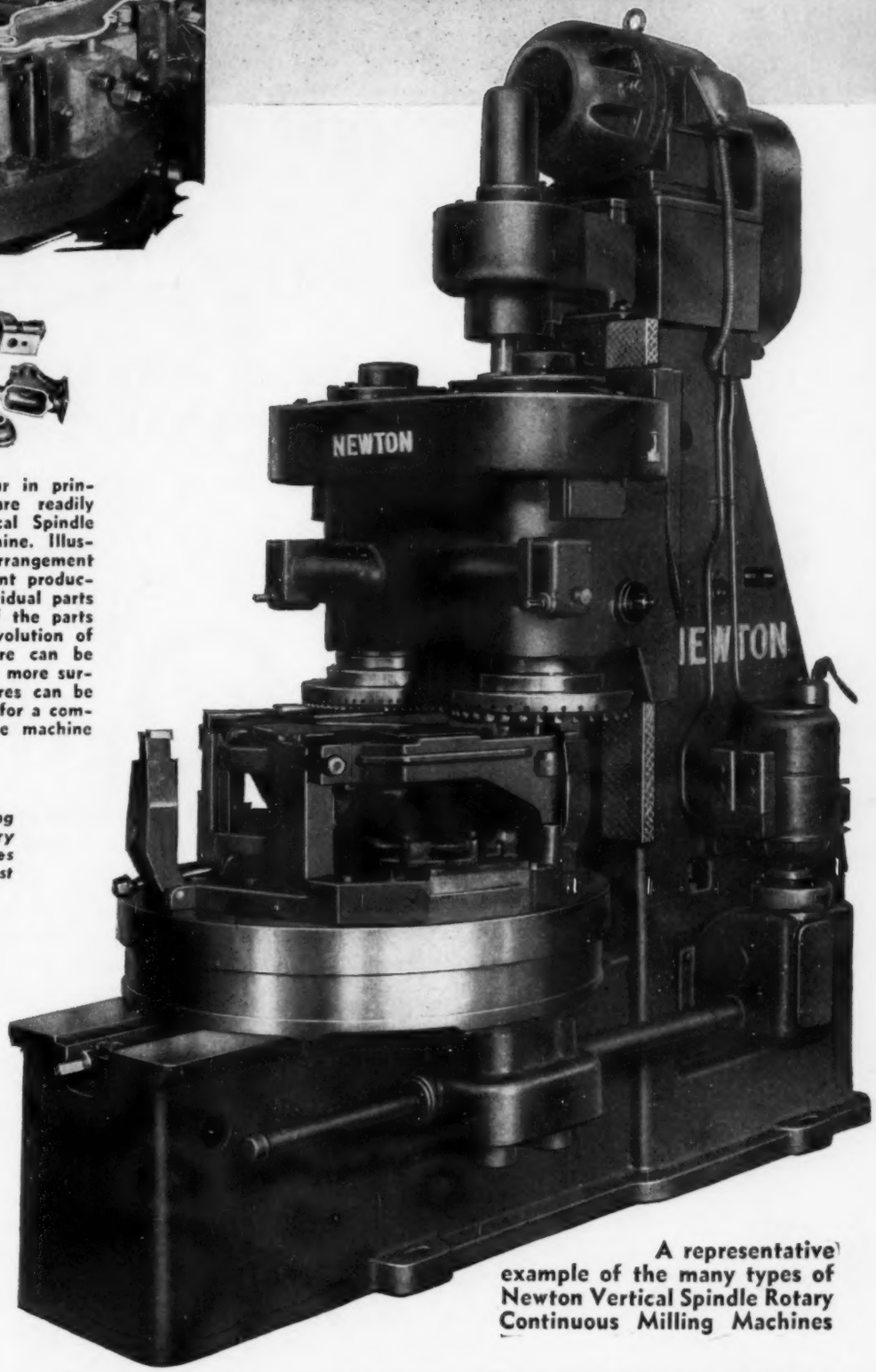
Let one machine with one operator do the work of several





Work-piece arrangements, similar in principle to that shown above, are readily handled on any Newton Vertical Spindle Rotary Continuous Milling Machine. Illustrated here is a fixture arrangement especially adapted to smaller plant production where the quantity of individual parts to be finished is limited. All of the parts shown can be milled at one revolution of the table. Similarly, the fixture can be arranged to accommodate two or more surfaces of the same piece. Fixtures can be arranged to mill all parts needed for a complete assembly, thus keeping the machine in continuous production.

Complete information covering Newton Vertical Spindle Rotary Continuous Milling Machines will be furnished upon request



A representative example of the many types of Newton Vertical Spindle Rotary Continuous Milling Machines

Among Heavy Machine Tools built by Consolidated are . . . .

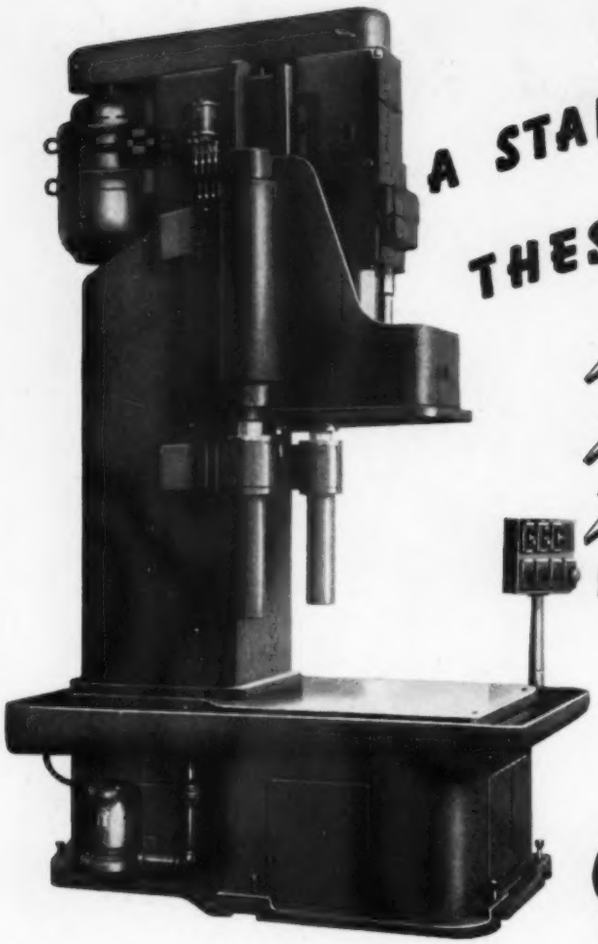
LATHES
BORING MILLS
DRILL PRESSES
MILLING MACHINES
BORING MACHINES
COLD SAW MACHINES
PLANERS
SLOTTERS
RAILROAD SHOP TOOLS
AUTOMOTIVE TOOLS
AND OTHER
SPECIAL MACHINES

BUILDERS OF HEAVY DUTY MACHINE TOOLS SINCE 1861

BETTS • BETTS-BRIDGEFORD • NEWTON • COLBURN • HILLES & JONES • MODERN

CONSOLIDATED
MACHINE TOOL CORPORATION

ROCHESTER 10, NEW YORK



A STANDARD MACHINE WITH THESE 3 Advantages

- LOWER INITIAL COST
- REDUCED MAINTENANCE
- EASILY ADAPTED TO SPECIAL PURPOSE OPERATIONS

THE Robbins No. 3 Drillmatic

The Robbins No. 3 DRILLMATIC is designed and built as a STANDARD MACHINE specifically for special purpose drilling, reaming, tapping and boring operations *at lower cost*. Drill heads with any number of spindles are easily mounted on the tooling saddle and by use of auxiliary units around a special base, multiple operations may be performed vertically, horizontally or any angle in between. When operations are changed, the No. 3 Drillmatic can be economically converted to the new job.

Old-type soft ways are replaced by large diameter guide bars in the saddle. These bars slide in guide bushings on the oversize machine column. Both the bars and bushings are hardened and ground alloy steel . . . automatically lubricated. The saddle is actuated by a sturdy hydraulic ram directly over the work, reducing friction on the guide bars and further contributing to the life-time wearing qualities of both the bars and bushings.

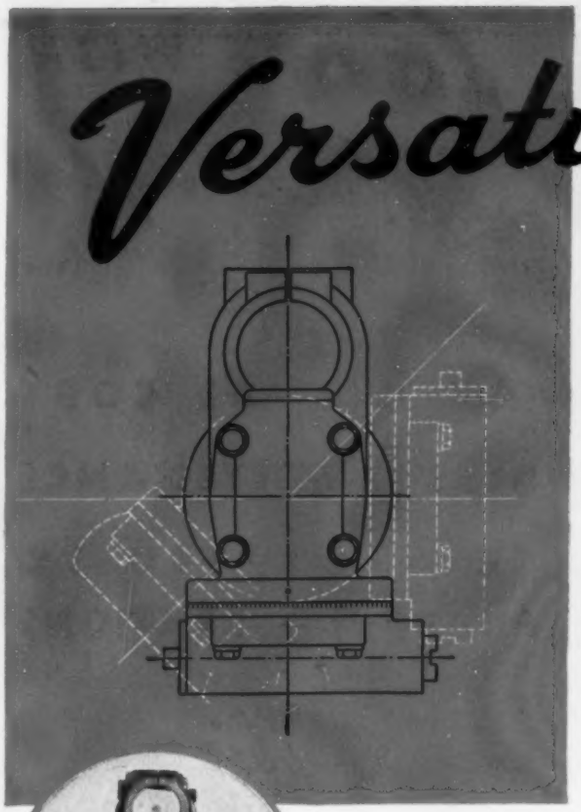
The hydraulic power is contained in a compact unit which is stationary at the top of the machine column . . . no outside piping or valves and all connections are manifolded inside the unit . . . no leaks. Two separate adjustable feed rates are supplied and a wide variety of speeds is obtainable by using change gears within the unit or by changing V-belt pulleys.

Send for illustrated catalog which details the many "plus" features of construction and operation. Study them over; then consult with Robbins engineers on the applications in your plant. Robbins is qualified to design and build the tooling for your entire job . . . tooling that will do the job faster, better, more economically. ***Robbins Engineering Company, 318 Midland Avenue, Detroit 3, Michigan.***

Robbins ENGINEERING COMPANY

Producers of ROBBINS MAGNA-SINE • ROBBINS UNIV-ANGLE ROBBINS SINE PLATE • ROBBINS INDEX TABLES ROBBINS No. 3 DRILLMATIC • SPECIAL MACHINERY

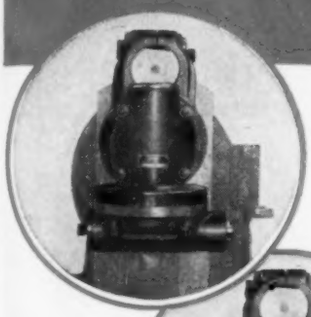
Versatility PLUS!



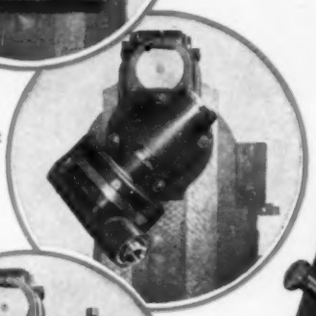
Kempsmith Universal Attachment TRIPLES the Scope of Your Horizontal Miller!

Horizontal milling machines become three times more useful when you add a Kempsmith Universal Milling Attachment... a combination that enables you to handle vertical, angular and spiral milling in addition to horizontal milling. A small investment brings in extra profits from jobs like rack milling, jig boring, die sinking, oil grooving, tang slot milling, etc. Like all Kempsmith Attachments, this one is rugged, precision-built, dependable . . . true to the 58 year old Kempsmith tradition. Anti-friction bearings throughout. High speed — Spiral gears step up cutting speed to 4 to 1 ratio. Light-weight — easily mounted by one man. Investigate this handy attachment. Write for Bulletin No. 113.

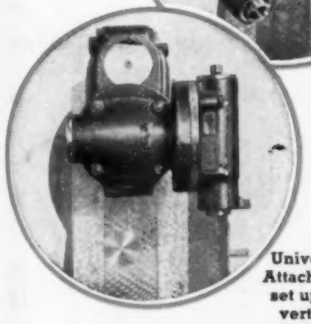
THE KEMPSMITH MACHINE CO., MILWAUKEE 14, WIS., U.S.A.



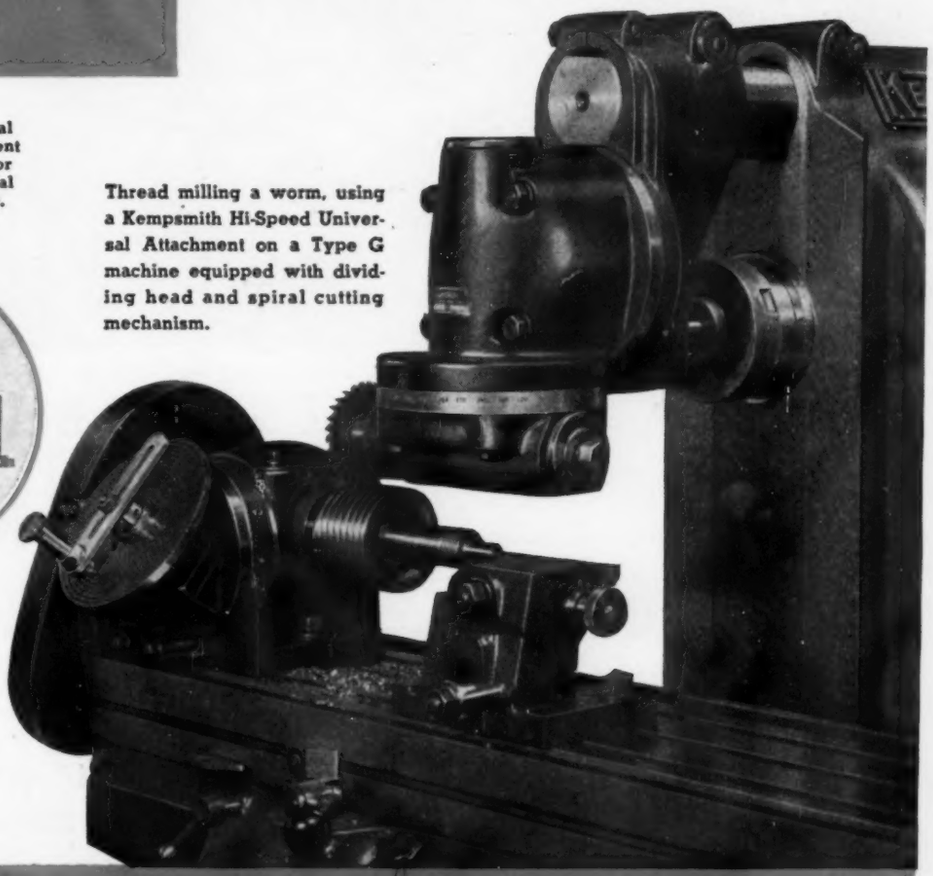
Universal Attachment set up for horizontal milling.



Universal Attachment set up for angular milling.



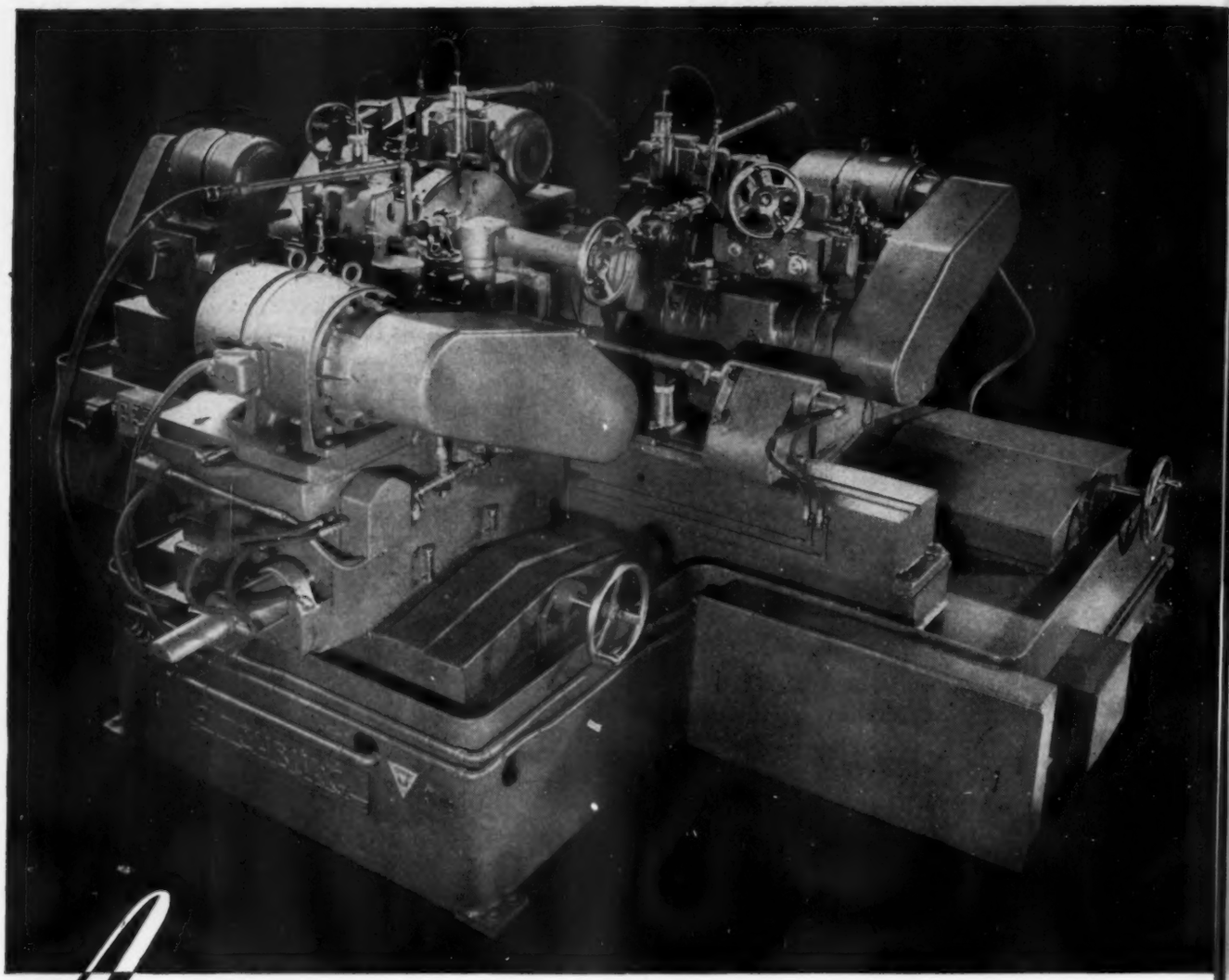
Universal Attachment set up for vertical milling.



Thread milling a worm, using a Kempsmith Hi-Speed Universal Attachment on a Type G machine equipped with dividing head and spiral cutting mechanism.

KEMPSMITH

Precision Built Milling Machines Since 1888



Again THREE HEADS ARE BETTER THAN ONE

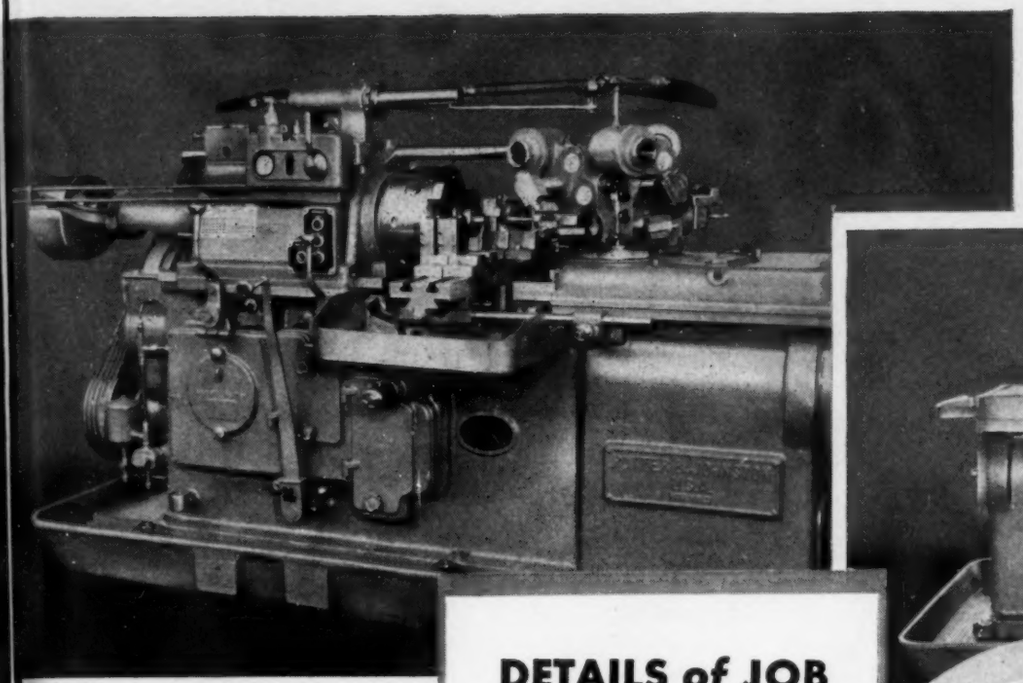
. . . Because Fitchburg engineers have combined three standard Bowgage Grinding Heads on a special base to plunge-cut grind three spottings on a 96" torsion spring for tanks. All three dimensions are ground at the same time—and within the time of the longest single grinding operation — and in one handling, with the consequent saving in time and reduced danger of spoilage.

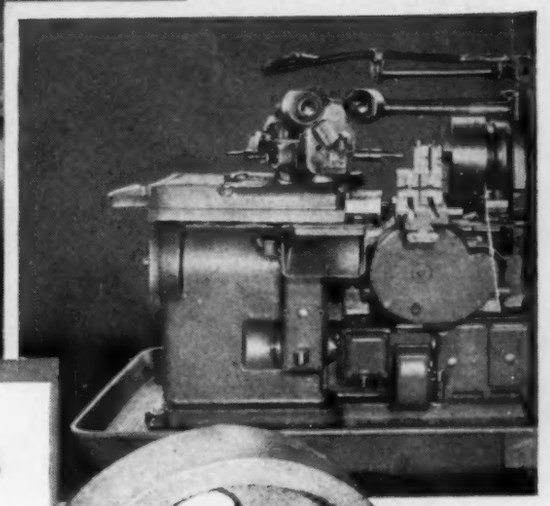
Get the complete facts. The open engineering mind instantly makes a favorable comparison between Fitchburg automatic precision grinding and any other equipment on the market! Install the Fitchburg method now and use your "Head" to cut costs and speed production.

Send your blueprints for our engineers' recommendations. There will be no obligation.

A triple-head Fitchburg Grinder like this may be converted into one double-head grinder and one single-head grinder, or three single grinders. Heads are interchangeable — save your investment.

FITCHBURG GRINDING MACHINE CORP.
FITCHBURG, MASSACHUSETTS, U. S. A.
Manufacturers of—Bowgage Wheelhead Units, Multiple Precision Grinding Units, Cylindrical Grinders, Gear Grinders, Bath Full Universal Grinders and Special





DETAILS of JOB

Procedure:

Grip in 3 holes in web with 3 chuck jaws.

Machine as follows:

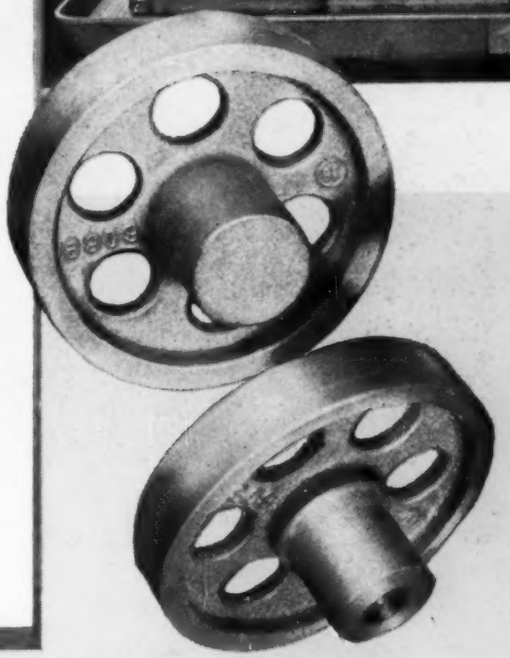
1st T.F.—Drill hole.

2nd T.F.—Rough turn O.D.; face both sides at rim; face one end of hub; chamfer hole.

3rd T.F.—Bore hole; turn O.D.; face rim.

4th T.F.—Ream hole.

5th T.F.—Size turn O.D.



This P & J 4-D AUTOMATIC

. . . like all P & J Machines . . . is easily tooled for fast, accurate production . . .

Small or medium size parts, as represented by the cast iron crank gear shown here, can be duplicated efficiently and at low cost on the P & J 4 D Automatic. The inherent versatility on tooling which characterizes all P & J Automatics makes it possible to provide setups which assure the maximum in productivity. The sturdiness, stamina and power of all P & J machines are such as to permit fast feeds and speeds and the utilization of carbide tools to greatest advantage.

In cases where lot size & production demands warrant a double spindle setup, P & J is prepared to meet requirements with two spindle machines in three different sizes.

Call on P & J for assistance on any problem involving the production of duplicate parts.

POTTER & JOHNSTON MACHINE CO.

Pawtucket, Rhode Island

GEARS

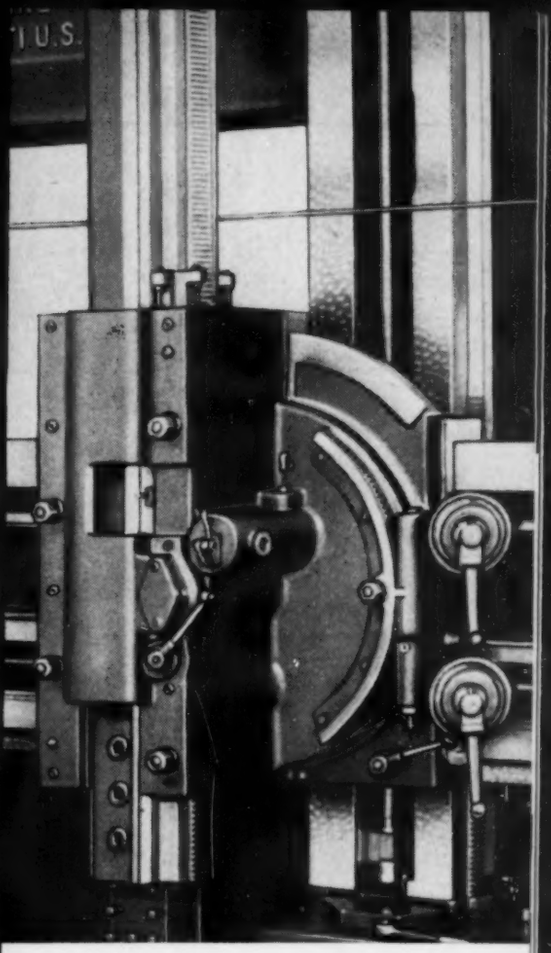
The **ADAMS** COMPANY

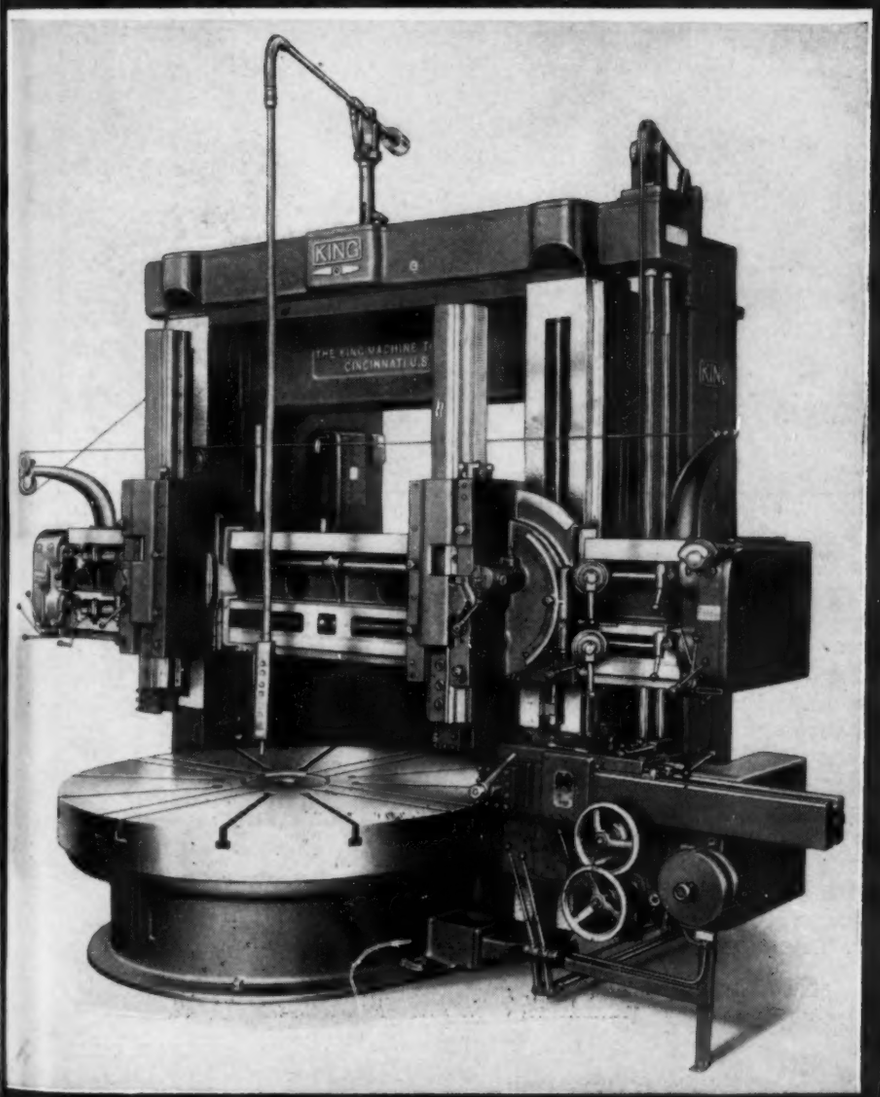
DUBUQUE, IOWA

ESTABLISHED 1883

Long Service At Low Cost With The New

KING





● The next time you're out in the shop watch how easily your operator handles his new KING Mill.

He'll select his speeds, set his feeds, rapid traverse the head to the job, make minute hand adjustment of the tool, start and stop the table—all from a single work position.

When you see those new, husky ram heads hog off the metal, you'll know you're getting better results with carbide tools.

You'll be impressed by the massive proportions throughout—for the machines are substantially heavier—the wide range of speeds and feeds, the clean cut, modern appearance.

And when you leave, you'll be convinced your selection of KING was a wise investment.

Available in 30", 36", 42", 52", 62", 72", 84", 100", 120", and 144" sizes.

THE KING MACHINE TOOL COMPANY

CINCINNATI 29, OHIO

Builders of Vertical Boring and Turning Machines Exclusively

When you think of Castings

...consider Forgings

and when you consider Forgings GET IN TOUCH WITH TUBE TURNS

In Re: Product Improvement

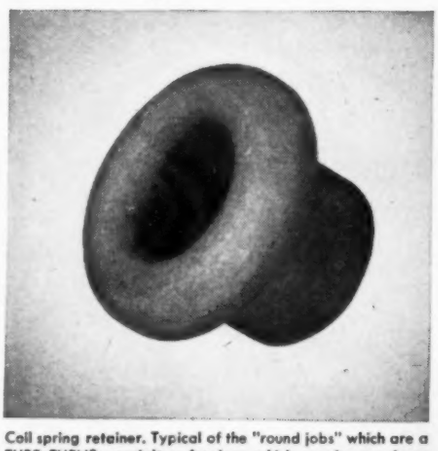
IF you manufacture mechanical equipment, consider forgings for all parts which take the punishment. Forgings are not subject to porosity, shrinkage cracks or hot tears—weaknesses common to castings and the cause of many rejects and failures. The moderate additional cost is more than made up by increased stamina and user satisfaction.

And forgings *can* be had, when you deal with TUBE TURNS—better forgings.

Modern mechanical presses and upsetters are coordinated under one roof with complete die designing, die making, laboratory, and rough machining facilities.

TUBE TURNS (Inc.), 224 East Broadway, Louisville 1, Kentucky. Telephone Wabash 7551.

DISTRICT OFFICES at New York, Washington, D. C., Philadelphia, Pittsburgh, Cleveland, Detroit, Chicago, Houston, San Francisco, Los Angeles.



Coil spring retainer. Typical of the "round jobs" which are a TUBE TURNS specialty—forgings which require maximum forged tensile strength and must be economically turned out in mass-production quantities.

TUBE TURNS tt Forgings for Industry

PORTABLE HORIZONTAL DRILLING and TAPPING MACHINE

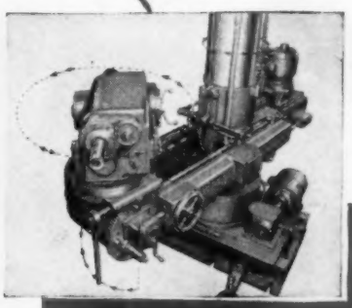
NEW

Featuring Compound Head Movement

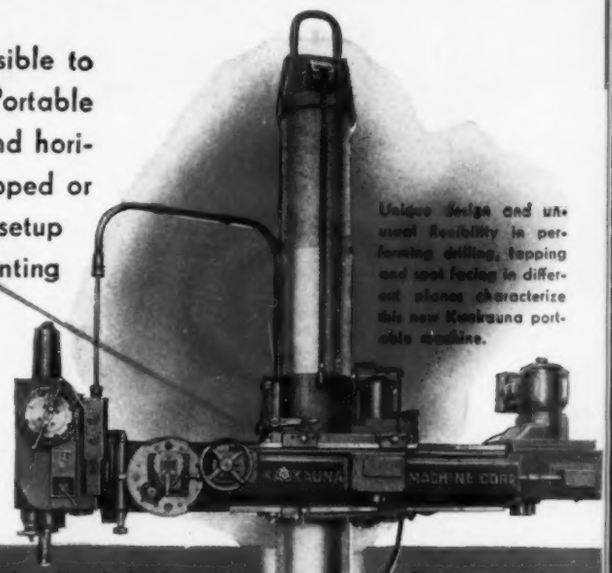
DRILLS, TAPS and SPOT FACES

MULTIPLE SURFACES IN A SINGLE SETUP

ough compound swivel movement of the machine head, it is possible to ition tools in any conceivable angle with the **new** Kaukauna Portable rizontal Drilling and Tapping Machine. Thus, angular, vertical and hori- tal surfaces of any casting or weldment may be drilled and tapped or faced. In many instances, it is necessary only to make one setup ause of the flexible machine movements which simplify presenting cutting tool to the work.

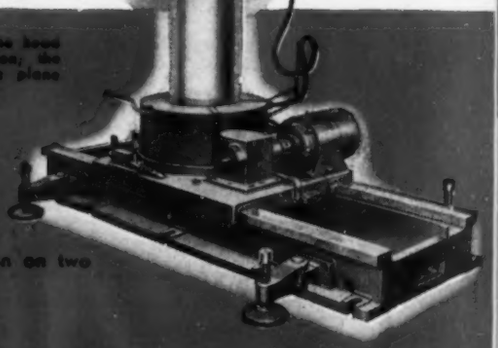


ne setup is required to complete all drilling, g and spot facing operations on this casting.



Unique design and unusual flexibility in performing drilling, tapping and spot facing in different planes characterize this new Kaukauna portable machine.

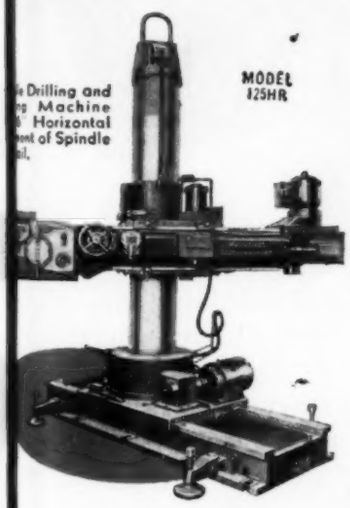
On this universal machine the head rotates 360° on its trunnion; the trunnion swivels 180° in a plane parallel to the rails.



These movements include:

1. Complete rotation of the head in either the horizontal or vertical plane.
2. 180° swivel of the head on its trunnion.
3. 24" horizontal adjustment of the head and trunnion on two sliding rails.
4. Complete rotation of head, rails and column.
5. Vertical movement of head and rails on the column.
6. Traverse movement of the complete column assembly on its runway.

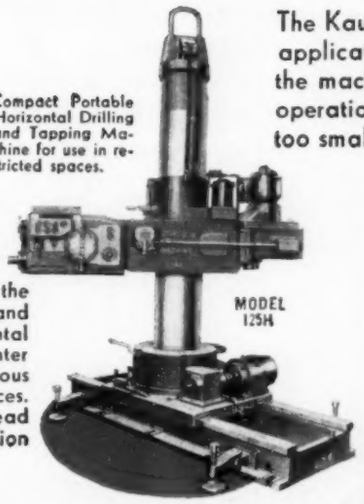
With these motions, limitless new drilling and tapping possibilities are opened by the new machine.



e Drilling and g Machine Horizontal ent of Spindle il.

MODEL 125HR

The Kaukauna Model 125-H machine is better suited to individual applications where the range of performance is secondary. Because the machine is very compact in design, many drilling and tapping operations can be completed in restricted and cramped areas too small for the Model 125-U or 125-HR machines.



Compact Portable Horizontal Drilling and Tapping Machine for use in restricted spaces.

MODEL 125H

aukauna Model 125-HR drilling and g machine is unequated for repetitive ions on various workpieces whose s can be placed at right angles to the e spindle. By combining 12" spindle and il movements, a total of 36" horizontal ent is obtained radially from the center column. This is particularly advantageous lling and tapping hard-to-reach surfaces. gidity is obtained by advancing the head workpiece. Thus, the need for extension and holders is eliminated.

COMBINATION INDEXING AND STATIONARY TABLE

gives you

1. Increased working range for many types of machine tools.
2. Single or multiple work settings at any location.
3. Fast, accurate indexing of work for consecutive operations.

For machining operations, inspection and layout work, this 3' x 6' x 28" high, convenient indexing and stationary table permits a profitable increase in work range. T-slots are provided on top and end surfaces, permitting the table to be used as an angle plate.

Kaukauna MACHINE CORPORATION
KAUKAUNA, WIS., U.S.A.

Send Now FOR FREE CATALOG

descriptive of profit producing Kaukauna Machines and Indexing Table.

Staples Tool Engineers look in . . .

*UNEXPECTED PLACES!

To help you SAVE on Tool Costs and AVOID Production Lags

*Unexpected Places

often are routine, high production hole cutting operations, where high tool costs are accepted as *normal* (by the manufacturer) for the work produced. Here is a typical—and actual—example:

A prominent automotive manufacturer, using H.S.S. reamers for finishing close tolerance holes in cylinder blocks, found this operation lagging far behind in production. Due to the material being reamed, the tools became dull after running two to three hours, causing frequent down time for changing tools. Overtime did not eliminate the bottleneck, and a second machine was ordered for this operation.

Staples Tool Engineers recommended a trial using special Staples Carboloy-tipped Reamers. As a result, the operation is now run continuously for *four days* without a shut-down for tool resharpening—and the required work output is maintained without the addition of a second machine.

Tools that produce savings such as these are worth a trial in *your* production. Call in a Staples Tool Engineer for an on-the-job demonstration. There is no obligation.

THE STAPLES TOOL COMPANY
CINCINNATI 25 OHIO
Distributors in Major Cities

Staples CARBOLOY-TIPPED CIRCULAR CUTTING TOOLS
REAMERS • CORE DRILLS • SPOT FACERS • COUNTERBORES • END MILLS • SHELL END MILLS • ALSO A COMPLETE LINE OF CIRCULAR SPECIAL TOOLS

Save 3 ways with...

KRW ARBOR PRESSES

SAVE *with* KRW
HAND-OPERATED PRESSES

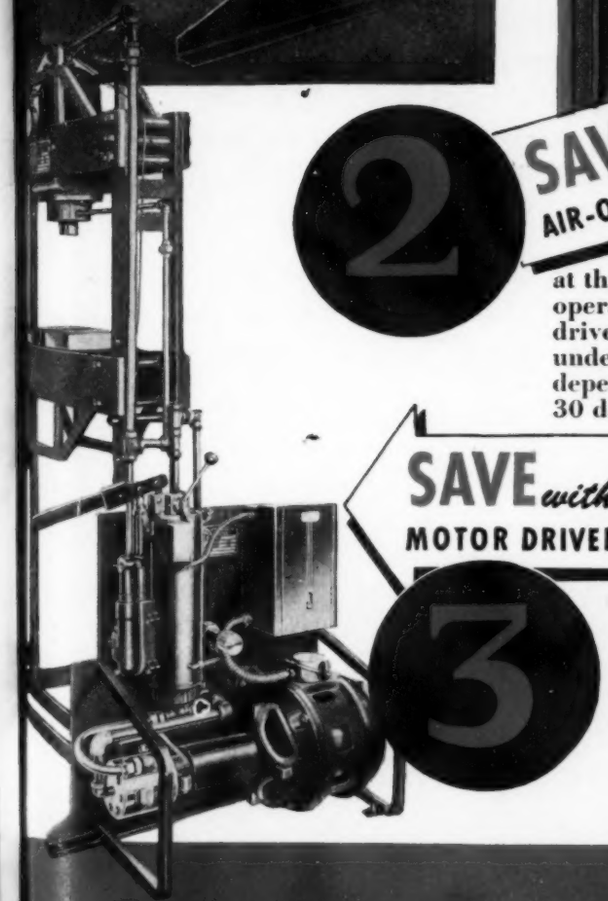
1

You name the job, and we'll name the KRW Press best fitted to do it better, faster, and at lower cost. Take KRW Hand-operated presses for example: they give more power with less effort...combining faster ram travel with a quick-acting finger controlled valve that makes the KRW Press outstanding in efficient hydraulic action. Twin pumps enable operator to vary ram speed. The special "Capstan" type handwheel brings the ram to the work fast as well as providing a "built-in" mechanical press for the lighter jobs. 30 days delivery guaranteed. Write for prices and catalog.

SAVE *with* KRW
AIR-OIL OPERATED PRESSES

2

KRW Hydraulic Presses equipped with our "Speedi-Booster" operate on compressed air, providing tons of pressure at the ram by effortlessly raising or lowering the operating lever. In operation, compressed air enters an air cylinder, the piston of which drives the smaller hydraulic oil piston which, in turn, forces the oil under pressure to the large cylinder piston. Tonnage pressures are dependent upon initial air pressure and size of air and oil cylinders. 30 days delivery.



SAVE *with* KRW
MOTOR DRIVEN PRESSES

3

Here is a self-contained power unit that drives KRW Hydraulic Presses. These units can be purchased separately to drive any existing KRW Press. The KRW Motor Driven Hydraulic Presses are low-cost, production units ideally suited for short runs or small work.

Presses are equipped with Seco Radial type pumps in capacities ranging from 3,000 to 10,000 PSI. Guaranteed by both the manufacturer and K. R. Wilson. Write for prices.

K. R. WILSON
215 MAIN ST., BUFFALO 3, N.Y.

K. R. Wilson, 215 Main St., Buffalo 3, N. Y.
Please send me information regarding
KRW Hand-operated Presses ☐
KRW Air-oil Operated Presses ☐
KRW Motor Driven Presses ☐

19

Name .....

Address .....

City ..... *Zone* ..... *State* .....

ELIMINATES END THRUST

● All of these machines feature the continuous tooth herringbone geared, sixteen speed headstock *exclusively*. This form of gear tooth provides more tooth contact, resulting in greater strength, smoother action with end thrust eliminated through the opposed helix angle. One of the many Sidney features insuring a long, accurate machine life.

This exclusive feature, with its smooth flow of power, also accounts for the successful use of carbide cutting tools on so many jobs.

For power—rigidity—and precision investigate Sidney on your next lathe requirement. Bulletins on all sizes available.

Sidney Lathes

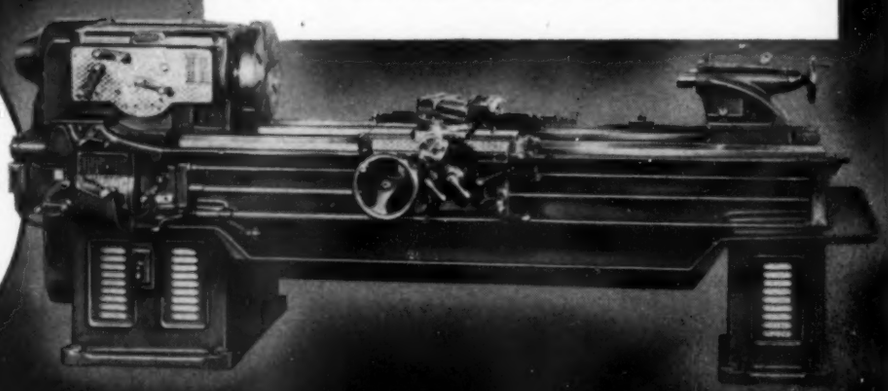
Builders of Precision Machinery

THE SIDNEY MACHINE TOOL COMPANY

SIDNEY • OHIO

SIDNEY

ESTABLISHED 1904



When Operators SMILE Your Shop HUMS!

AND metal cutting operators *do* smile when they work with Cimcool. They say there's never been anything like it. And they're right, for Cimcool is something entirely new—A *chemical emulsion* incorporating an entirely new principle in cutting fluids. It's tops with operators seven ways:

1. It's clean—doesn't soil hands or clothes.
2. Can't smoke—causes no harmful vapors.
3. Produces no objectionable odors.
4. No slippery film on hands, machine or floor.
5. No chromates or other skin irritants.
6. Is not subject to rancidity.
7. Tools and chips actually stay cool to touch.

OTHER CIMCOOL ADVANTAGES

- Cools faster—allows faster cutting.
- Uniform temperature increases accuracy.
- No fire hazard—Cimcool can't burn.
- Contains long-lasting rust inhibitor.
- Chemical lubricity increases tool life.
- Covers 85% of all metal working jobs.

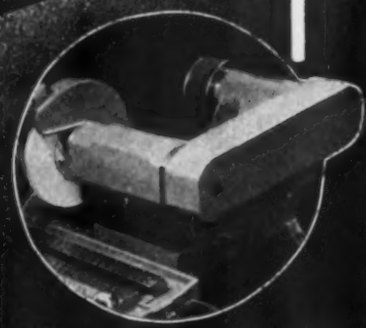
CIMCOOL

THE MULTI-PURPOSE CUTTING FLUID

CIMCOOL DIVISION of THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO, U. S. A.

Designed for EFFICIENCY

TO PRODUCE MORE OF A GREATER VARIETY THRU EASE OF PRECISION SET UP AND OPERATION



External Bracket

The Rivett No. 104 is a simple, power-driven grinder suitable for tool making and precision manufacturing. Operations of widely varying nature can be quickly set-up and efficiently ground on one or many pieces. Interchangeable brackets are selectively mounted on the cross slide for internal, external, or concentric grinding in straight, taper, face or shoulder form.

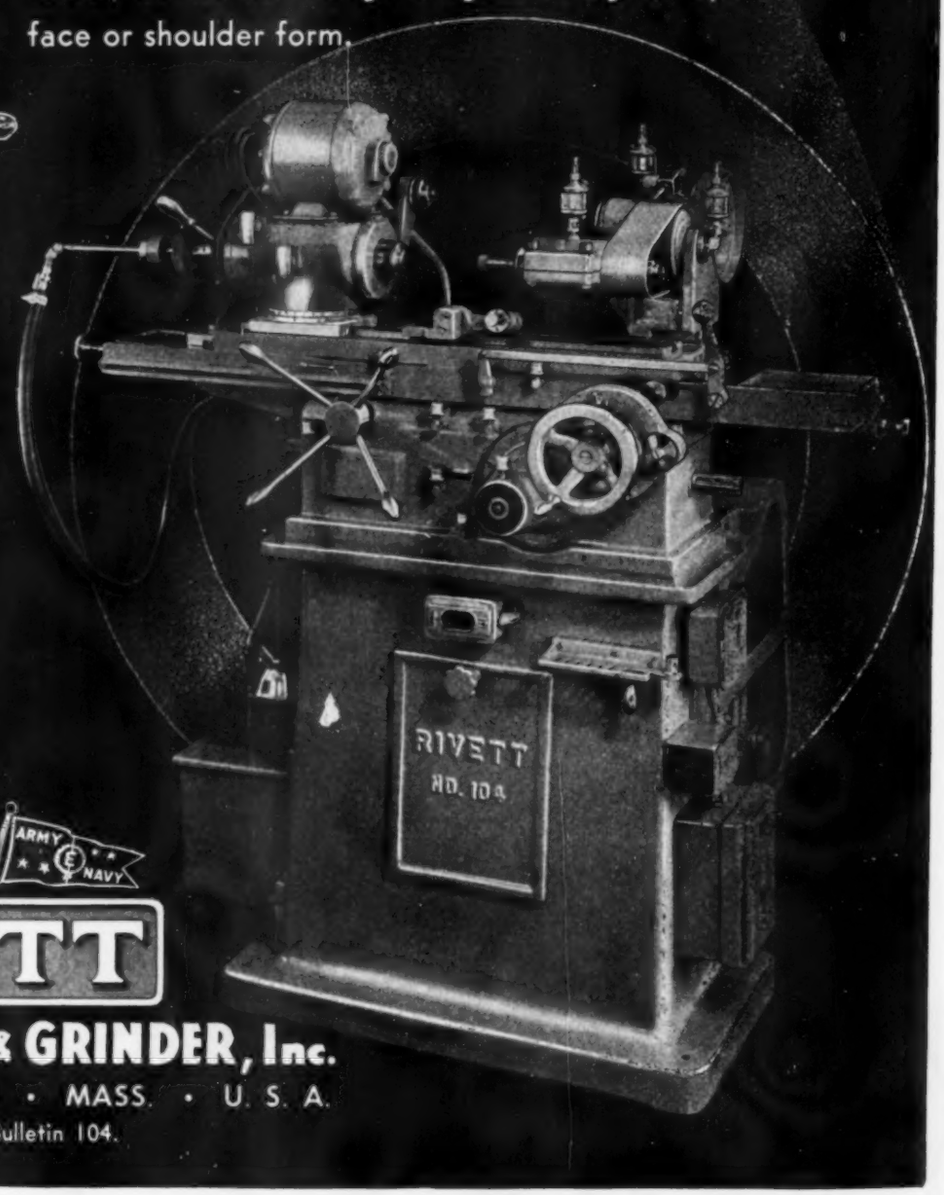
Internal, External Turret

RANGE

Internal spindles of suitable design and speed may be selected for hole grinding up to approximately 3" diameter and 4" length.

External bracket with 7" x ½" wheel may be used for on-center or chucked work up to approximately 3" diameter.

Turret for concentric grinding of hole or outside surface is limited to such work as may be chucked.



ARMY E NAVY

RIVETT

RIVETT LATHE & GRINDER, Inc.

BRIGHTON · BOSTON · MASS. · U. S. A.

Write for Bulletin 104.

The CONE AUTOMATIC MACHINE COMPANY sees many GOOD THINGS AHEAD

It is reported that . . . . . .

Danielson Mfg. Co. of Danielson, Conn., is making a soft hammerhead of nylon that won't chip or bounce.

get ready with CONE for tomorrow

Windshield glass can be kept warm when coated with an electrically conductive transparent film called "Nesa", manufactured by Pittsburgh Plate Glass Co.

be ready with CONE for today

Eastman Kodak's process of molding small lenses in an atmosphere of nitrogen promises, when manufacturing technique is refined, to produce lenses satisfactory for all but the most critical uses.

get ready with CONE for tomorrow

General Electric's new silicone paint is said to permit clearer, brighter colors for automobiles, refrigerators, electric ranges, etc., and to "last a lifetime."

be ready with CONE for today

Air Reduction Co. claims to have perfected a method of flame-cutting stainless steel to close tolerances at high speed without affecting the physical properties of the metal.

get ready with CONE for tomorrow

American Cyanamid Co. has installed hot water pipes under 600 feet of roadway connecting its plant with the highway. The heat will keep the road free from ice and snow.

be ready with CONE for today

The Mellon Institute has reported on the use of ethylsilicate as a vehicle in paint. Finishes made with it are said to resist heat, retard fire and not to darken with age.

get ready with CONE for tomorrow

C. G. Conn Ltd. has an electronic organ that produces its tones by vacuum tubes and is said to be equivalent to an organ with 1,333 pipes.

Bell Aircraft Corp. is making a vending machine mechanism that makes change.

be ready with CONE for today

The Dobeckmun Co. of Cleveland is making an aluminum foil yarn, protected by a plastic surface from corrosion, for use in textiles in combination with other yarns.

get ready with CONE for tomorrow

Seal Peel Inc., of Detroit, is sending a shipment of various products, protected only by plastic dip coating, on a round-the-world flight to test the value of this type of packaging in actual service.

be ready with CONE for today

Dow Chemical Company's "Styrofoam" is a pure white cellular insulating material with only 18% of the weight of cork.

Atlas Supply Co., makers of tires and accessories, is showing its wares in a showroom built inside a DC4 and called the "Sky Merchant."

get ready with CONE for tomorrow

Linde Air Products Co. calls its method of flame-cutting rock (as for oil wells) "fusion-piercing." It is said to have drilled holes as deep as 450 feet at an average rate of 10 feet per hour.

be ready with CONE for today

The "Solexol cold fractionation" process developed by M. W. Kellog Co. is expected to be used in seven plants now building throughout the world. The process resembles that used for petroleum, but is applied to many basic oils and fats including soy bean, linseed, tallow, sardine and shark liver.

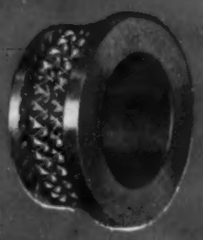
get ready with CONE for tomorrow

The R.C.A. electronic color television system will be made available to the entire industry.

FOLLOW THESE PAGES FOR NEWS OF PROGRESSIVE PRODUCTION

Impressively Conomatic!

This piece was produced from 2⅛" dia. S.A.E. 1112 by 18 tools in 12 seconds on a 2⅝" Eight-Spindle Conomatic.



Any good multiple spindle automatic should handle the ordinary run of work. But the *tough* jobs are profitable on Cones.

Ask your CONE representative to show you our new color motion picture

CONE

AUTOMATIC MACHINE CO., INC. ★ WINDSOR, VERMONT, U.S.A.

37

Selection and use of SPECIALTY

→ a basic library for metalworkers
→ ask your local Crucible branch

1 **Tool Steel for the Non-Metallurgist**—A 32-page book for the non-metallurgist on the different types of tool steels, explaining the purposes for which each is best adapted and giving suggestions for heat treatment. 5½" x 7½".

2 **Warehouse Stock Book**—Lists the full range of steels . . . high speed, tool, die, stainless, alloy, machinery, and special purpose . . . ready for prompt delivery from the stocks of the 26 conveniently located Crucible warehouses. Contains descriptions, applications, heat treating, and working instructions, together with many useful tables. 160 pages, 5½" x 8¾".

3 **Rex High Speed Tool Bits**—An 8-page folder giving the characteristics and applications of the Rex line of high speed tool bits, with useful suggestions on tool bit grinding and a list of available stock sizes.

4 **Characteristics of Rezistal Stainless Steels**—Folded tabulation, opens up to 8¾" x 31¾", listing grades, analyses, type numbers, properties, heat treatment, and instructions for forging, cold working, drawing, machining, and welding Crucible's Rezistal stainless steels.

5 **Max-el Machinery Steels**—A 12-page folder containing chemical and physical data with stock information on Max-el machinery steels, including typical applications.

6 **Rexalloy Cast Non-Ferrous Cutting Alloy**—An 8-page folder on Rexalloy tipped tools and tool bits for applications between high speed steels and tungsten carbides. Gives range of speeds and feeds on various materials, lists bit sizes available, and explains economies possible with increased efficiencies.

7 **Steel Analyses**—Handy, washable wall chart, listing analyses of most generally used high speed, tool, stainless, alloy, machinery, and special purpose steels. Twelve pages, 8½" x 11", visible index.

8 **Data Sheets on Various Steels**—Individual 2-page and 4-page data sheets, punched to fit standard 3 ring binder, available on a full range of grades of each of the following types of steels:

HIGH SPEED • HOT WORK • DIE CASTING DIES
AIR, OIL, AND WATER HARDENING TOOL STEELS
PLASTIC MOLDING • ALLOY • MACHINERY

STEELS

Each data sheet gives complete information on analysis, applications, critical temperature, forging, annealing, hardening, tempering and hardness, together with TTT curves where pertinent. Binder and tabbed manila separate sheets for each section will be supplied on request. Send for data sheets on all types of steels you use. Sheet size is 8½" x 11".

Write or ask your nearest Crucible branch office and warehouse today for any or all of the items in this valuable metalworking library. Your choice of this literature is yours for the asking to help you in the selection, treatment, and use of Crucible's

High Speed . Tool . Die . Stainless . Alloy Machinery . Special Purpose Steels

All of this steel . . . a full range . . . is made by Crucible. It is of uniformly high quality . . . the result of years of successful experience in producing specialty steels to meet exacting standards of materials and workmanship.

Got a problem? Call Crucible!

Crucible offers you the personal services of competent metallurgists, mechanical engineers, and other experienced men to help you solve problems connected with the selection, working, and heat treatment of specialty steels. These services are rendered without charge or obligation, whether or not you are a customer. Just call or write your nearest Crucible branch office and warehouse, listed at the left, and tell them what you're up against.

Ample Warehouse Stocks

Each of Crucible's 26 branch offices and warehouses carries complete stocks of all sizes and grades of specialty steels normally used in its territory. Your orders get prompt attention. Deliveries are equally prompt. Consider your Crucible warehouse as your main stockroom for the full range of specialty steels, thus reducing your inventories and simplifying and centralizing your buying.

CRUCIBLE STEEL COMPANY of America

CHRYSLER BUILDING
405 Lexington Ave., New York 17, N. Y.

Crucible Steel Company of America
Dept. A-6, 405 Lexington Avenue
New York 17, N. Y.

Please send me the free Crucible literature, as checked at right and below. I have checked numbers corresponding to illustrations and descriptions.

Send separate data sheets on following types or analyses of steels: .....

.....

.....

NAME ..... TITLE .....

FIRM .....

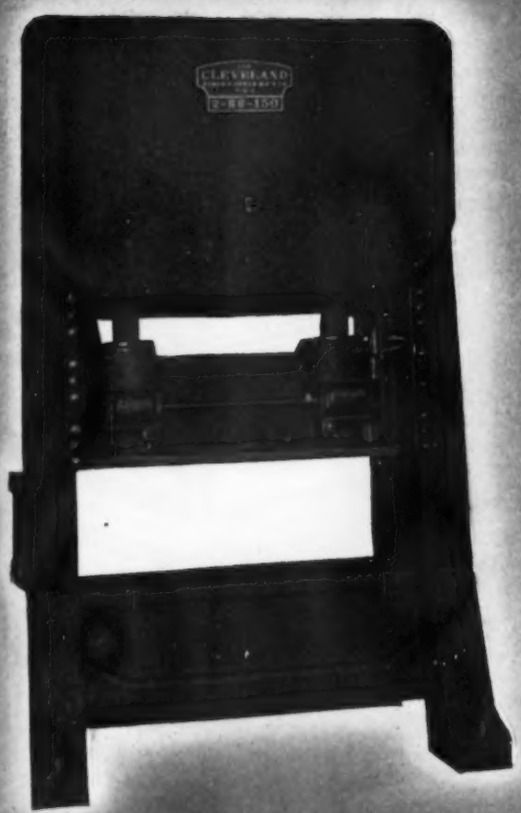
STREET .....

CITY ..... ZONE .....

STATE .....

1 . . .
2 . . .
3 . . .
4 . .
5 . . .
6 . . .
7 . . .
8 . . .

Modern CLEVELAND Presses



Cleveland 2-60-150 Two Point Press having a bed area of 36"x66"; 12" stroke and 150 tons capacity.

Cleveland 2-120-350 Two Point Press having a bed area of 48"x120"; 10" stroke and 350 tons capacity.

Designed to meet the most exacting requirements of modern manufacturing, Cleveland Two Point Presses are highly efficient, productive and economical in operation.

Their rugged compact construction assures long life and low upkeep while the features incorporated in their design provide faster, better and more accurate production.

Built in a wide range of sizes, they can be furnished in capacities to meet particular requirements.

The CLEVELAND PUNCH & SHEAR WORKS COMPANY. . Cleveland 14, Ohio

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PITTSBURGH · · · · CHICAGO

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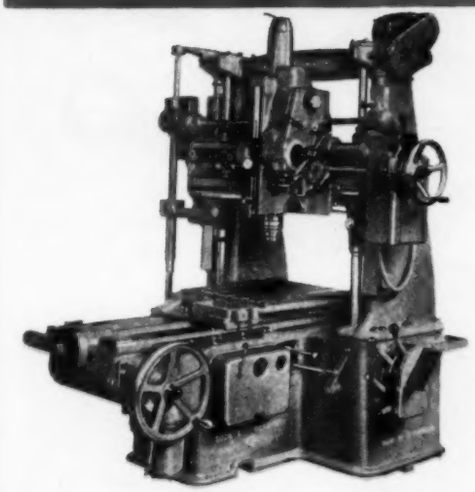
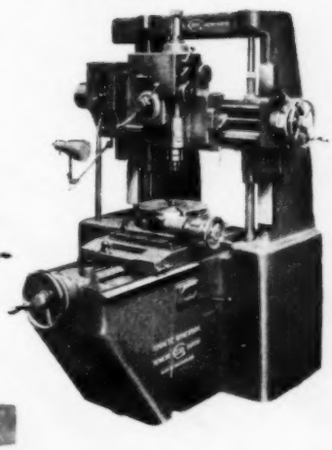
Convenience - Wide Range And Exceptional Precision

Above: SIP Hydroptic-B Jig Boring and Milling Machine. Table size, 39½"x32". Accuracy for settings of work-table and spindle head guaranteed to 0.0002". Optical measuring system makes the Hydroptic-B also a measuring instrument of unquestioned accuracy.

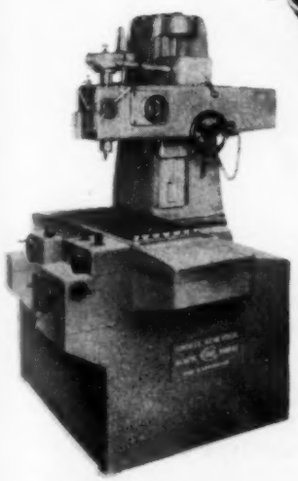


Above: SIP No. 4G Jig Borer. Table size, 27½"x23⅝". Built-in micrometers give direct readings to 0.00005".

Right: SIP No. 3K Jig Borer with table 21½"x15". Direct readings can be made to 0.00005" on the built-in micrometers.



Below: The newest SIP Jig Borer No. 2H incorporates the same optical measuring system as that of the Hydroptic-B. All settings are guaranteed accurate to 0.00015". Table size, 27½"x12½".



JIG BORERS

American manufacturers who must have the ultimate in precision machining may now obtain all the advantages of famed Swiss workmanship by selecting SIP Jig Borers. Exceptional precision, sturdiness of construction and time-saving features of set-up and operation insure dependable operation over a wide range of work. The Hydroptic-B Jig Boring and Milling Machine (illustrated above) is equipped with a built-in optical measuring system which is completely protected and entirely free from mechanical stress. This advantageous feature has also been employed in the smaller SIP Jig Borer No. 2H (bottom illustration). Each of the complete line of SIP Jig Borers is capable of producing work of exceptional precision, and each is so dependable in operation that it is not only a metal-working machine, but also a measuring instrument of unquestioned accuracy. We represent in the United States the following Swiss manufacturers: Societe Genevoise d'Instruments de Physique (SIP), Andre Bechler, Mikron, Safag, Studer, Sallaz, Schaublin, Lienhard. With these lines to choose from, we can give expert advice in selecting the correct Swiss Machine Tools and Measuring Instruments for every job.

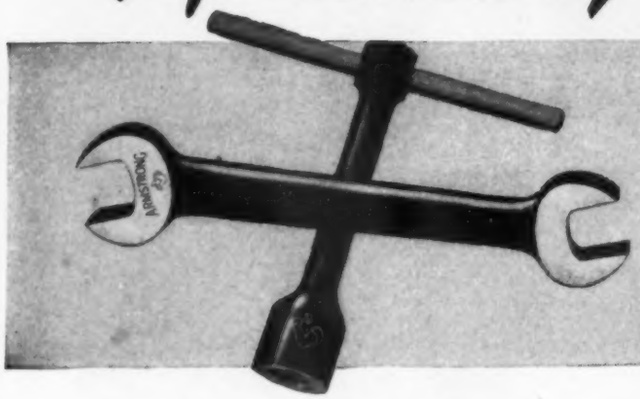
COSA CORPORATION

CHRYSLER BLDG.
New York 17, New York

HIGH PRECISION MACHINE TOOLS AND MEASURING INSTRUMENTS

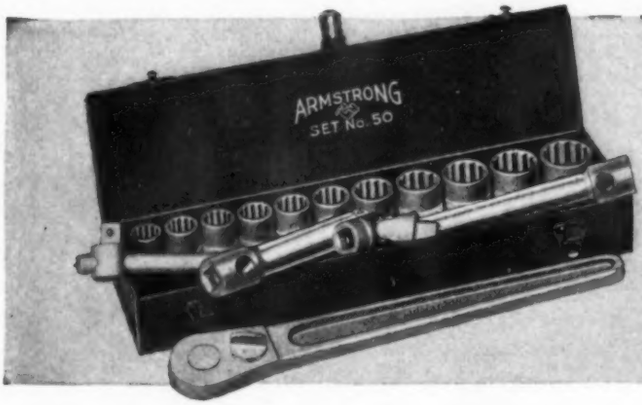
ARMSTRONG

Top Quality WRENCHES



Armstrong Drop Forged Carbon Steel Wrenches including 19 Different Types.

Armstrong Drop Forged Alloy Steel Wrenches including 12 different types.



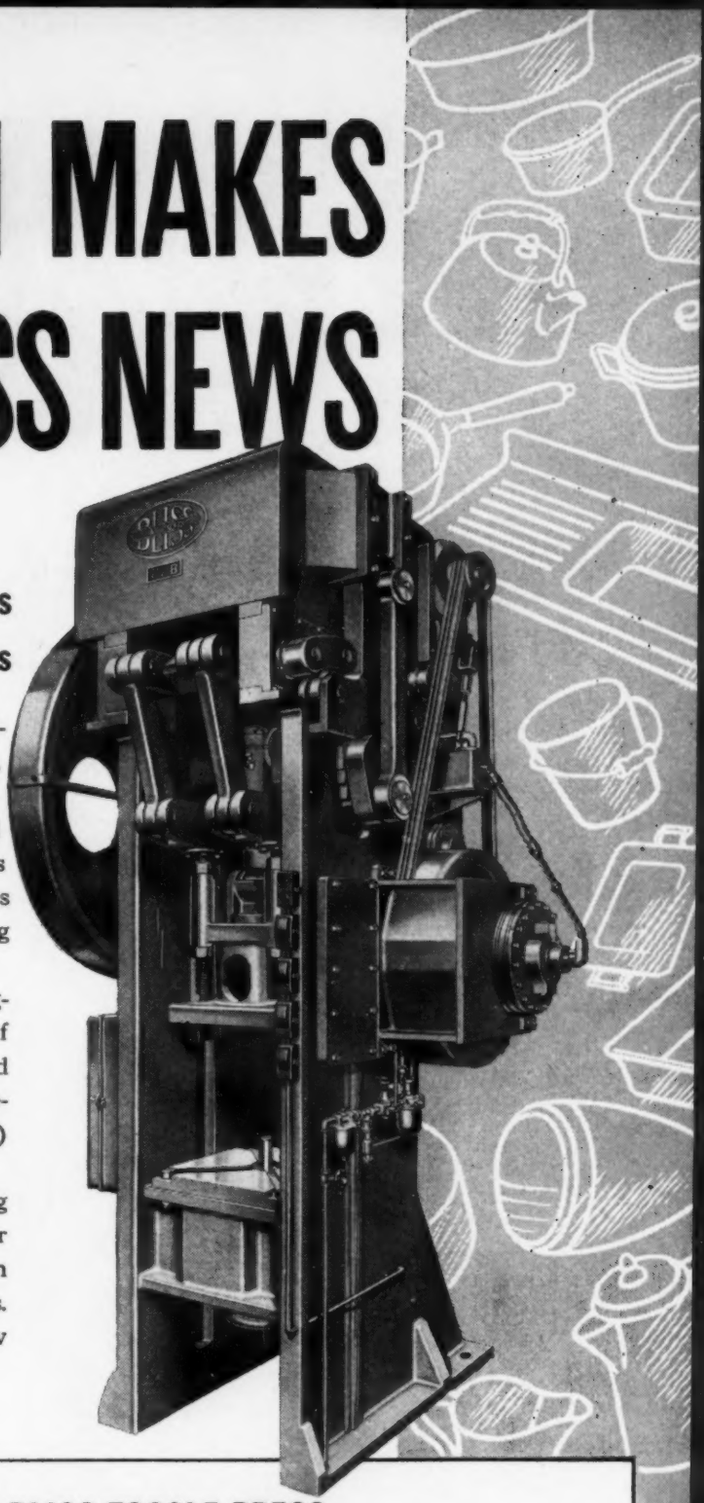
Armstrong Alloy Steel Detachable socket wrenches and driving units . . . a complete assortment of sets.

For Construction, Armstrong Drop Forged Ratchets. Construction and Structural wrenches in both Carbon and Alloy.

ARMSTRONG BROS. TOOL CO.

315 N. Francisco Ave. Chicago 12, U. S. A.
Eastern Whse. and Sales: 199 Lafayette St., New York 12, N. Y.
Pacific Coast Whse. and Sales Office: Mission St., San Francisco 3, Calif.

BLISS AGAIN MAKES TOGGLE PRESS NEWS



New Single-Crank Line in 8 sizes offers many design and operational advances

Always the pioneer in advanced toggle press engineering, Bliss now presents a new single-crank line, designed for increased drawing production and efficiency. If you draw cooking utensils, hollow ware and shells of any type, deep or shallow, from steel, brass copper, aluminum or other metals, these 1947 presses will prove profitable additions to your stamping equipment.

The new line comprises eight sizes of presses, ranging in shaft diameter from 4¼" to 7" and in length of stroke from 8½" to 24½". Die-space dimensions and operating speeds remain the same as those for corresponding models in the previous line (Nos. 1½ to 4A) thus permitting interchange of tooling.

Analyze the improved factors in the adjoining check-list of new features, incorporated only after thorough engineering research and testing. And then ask a Bliss Sales Engineer to provide complete details. He'll be glad to show you how to apply these new presses to your individual production problem.

FEATURES OF NEW BLISS TOGGLE PRESS

1. **Frames are one-piece stress relieved steel weldments**... resulting in weight-savings, and reduced floor space requirements.
2. **New toggle drive** provides crosshead with long gibways at position most needed...reduces bearing overhang... renders greater accessibility.
3. **New Bliss Single Disc Pneumatic Friction Clutch,** with one-station electric pushbutton control...air brake for stopping flywheel.
4. **Direct-connected liftout in bed.** Liftout rods are outside specified bed area, leaving space between uprights free and clear...handwheel adjustment on center liftout rod.
5. **Steel rockshafts,** yokes and links in blankholder mechanism.
6. **Steel gearing throughout.**
7. **Crankshaft, rockshafts, intermediate shaft** and link pin bearings are bronze bushed...roller bearings on driveshaft and flywheel.
8. **Bliss Manifold Lubrication System,** with metal tubing leading to each bearing.

E. W. BLISS COMPANY, DETROIT 2, MICHIGAN

Mechanical and Hydraulic Presses, Rolling Mills, Can and Container Machinery

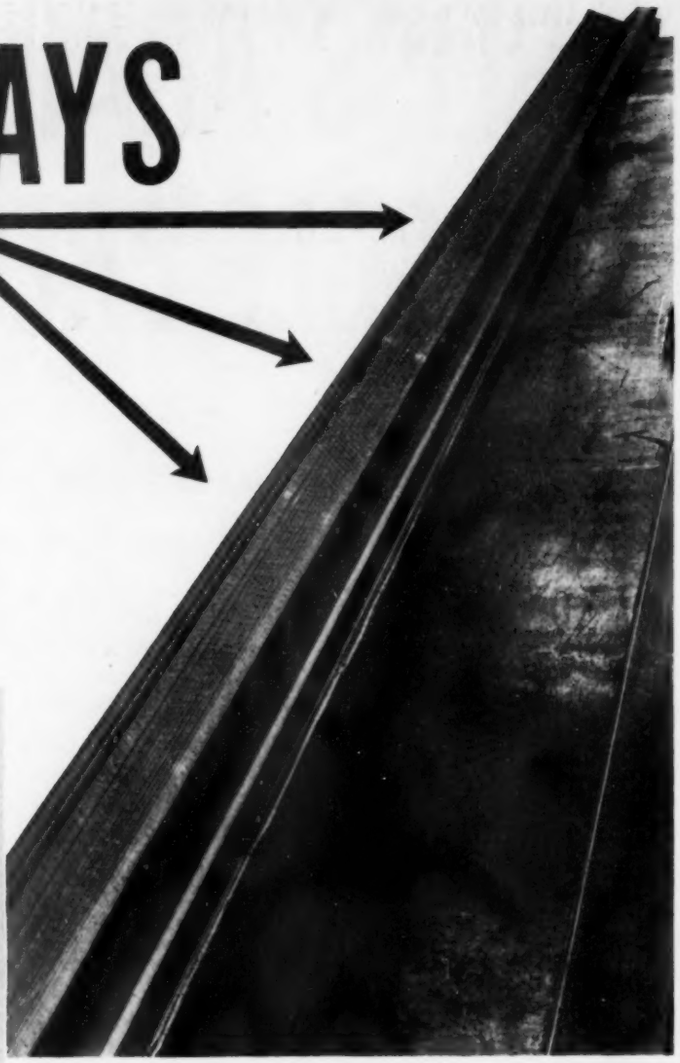
WORKS AT: Brooklyn, N. Y.; Toledo, Cleveland, Salem, Ohio; Hastings, Mich.; Derby, England; St. Ouen sur Seine, France • SALES OFFICES: Detroit; Brooklyn; Cleveland, Dayton, Toledo, Ohio; Lansing, Mich.; Chicago; Philadelphia; Rochester; New Haven; Boston; Toronto.

STAY AHEAD WITH *Bliss*

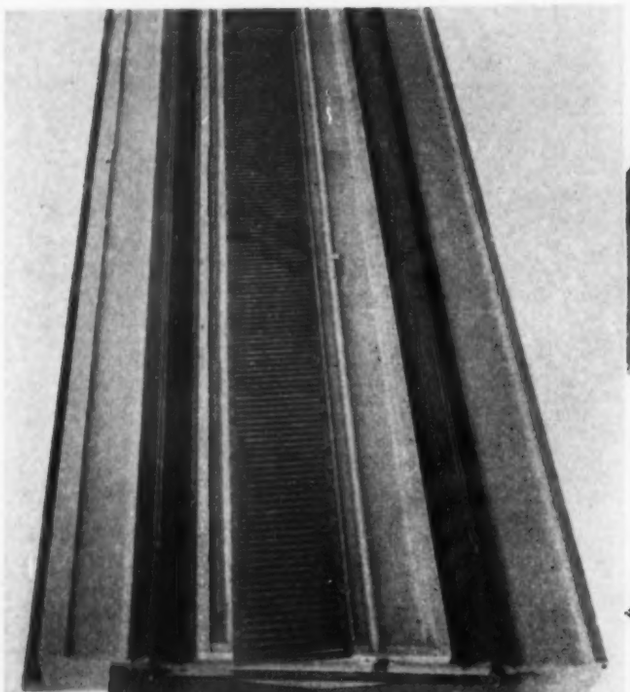
BLISS BUILDS MORE TYPES AND SIZES OF PRESSES THAN ANY OTHER COMPANY

Scored WAYS

the thief that robs your Planer Department of its accuracy



GRAY NON-METALLIC WAYS



***Drive him out*... of your plant by insisting on Gray**

NON-METALLIC WAYS*

the way that will not score

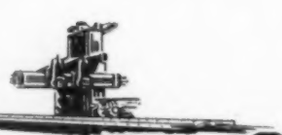
Remember

A planer is no better than its ways. There is no adequate substitute for the Gray NON-METALLIC WAY.

*** PATENTED and PATENT PENDING**

DOUBLE HOUSING and OPENSIDE PLANERS
•
SWITCH PLANERS
•
DIE BLOCK PLANERS
•
MILLING PLANERS

PLANER TYPE MILLING MACHINES
•
HORIZONTAL BORING MACHINES



***The G.A.* GRAY Co.**

CINCINNATI 7, OHIO, U.S.A.

LEAD CHECK SHOWS VARIATION OF ONLY

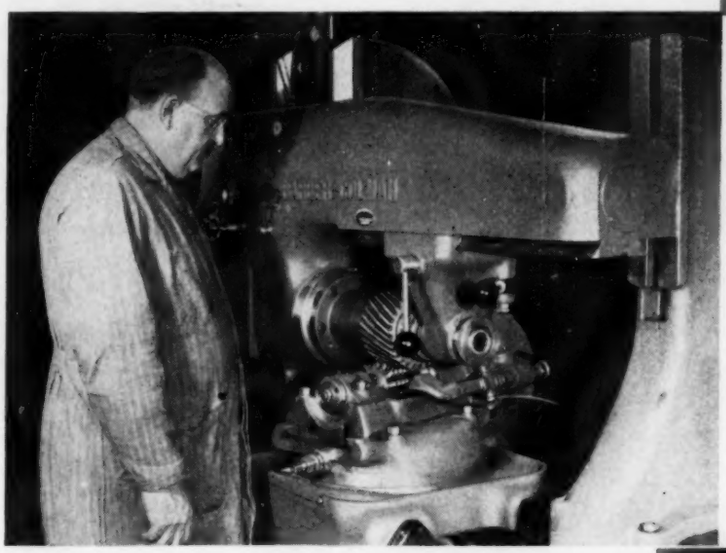
.00009" PER INCH

OF FACE WIDTH WITH BARBER-COLMAN TYPE D HOBBING MACHINE

TOOTH THICKNESS HELD ± .0005"

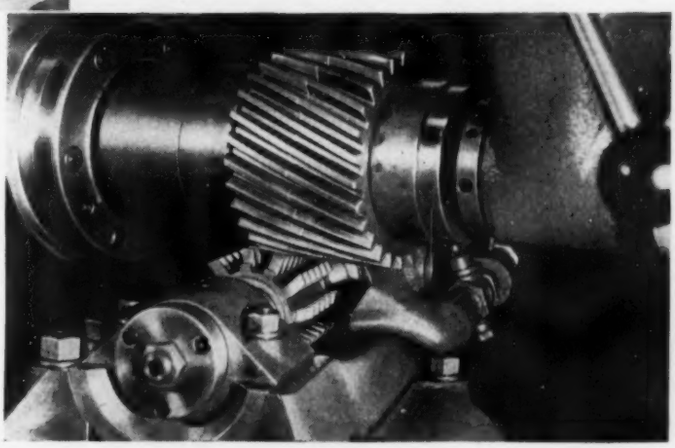
CHECKED OVER PINS . . . MAXIMUM VARIATION IN 8 HOURS CONTINUOUS HOBBING

Unretouched photograph of completed gear showing quality of finish obtained in one-cut hobbing.



This report from a customer operating a battery of six machines illustrates typical performance and dependability obtained from the Type D Hobbing Machine. During continuous operation, over-pin dimension showed a variation of only .001", and this was due to progressive wear on the hob teeth. Maximum lead error of .0004" over entire length of full load of gears was reported, and many loads checked within .0001". The flexibility of this Standard Machine for hobbing a wide variety of work — ranging from large heavy gears to long spline shafts — provides low-cost production efficiency with a minimum of investment in special equipment. Consistent accuracy is possible because of rigid massive construction, hardened and ground "V" ways, and positive mechanical control over all machine functions. We will be glad to furnish production estimates on your work, showing how this machine will quickly return original investment.

GET A COPY TODAY — Field applications and extra equipment for the Type D Hobbing Machine. Ask for Bulletin — F 1477.



ACCURACY-RIGIDITY-POWER BARBER B-C COLMAN **FOR HI-PRODUCTION HOBBING**

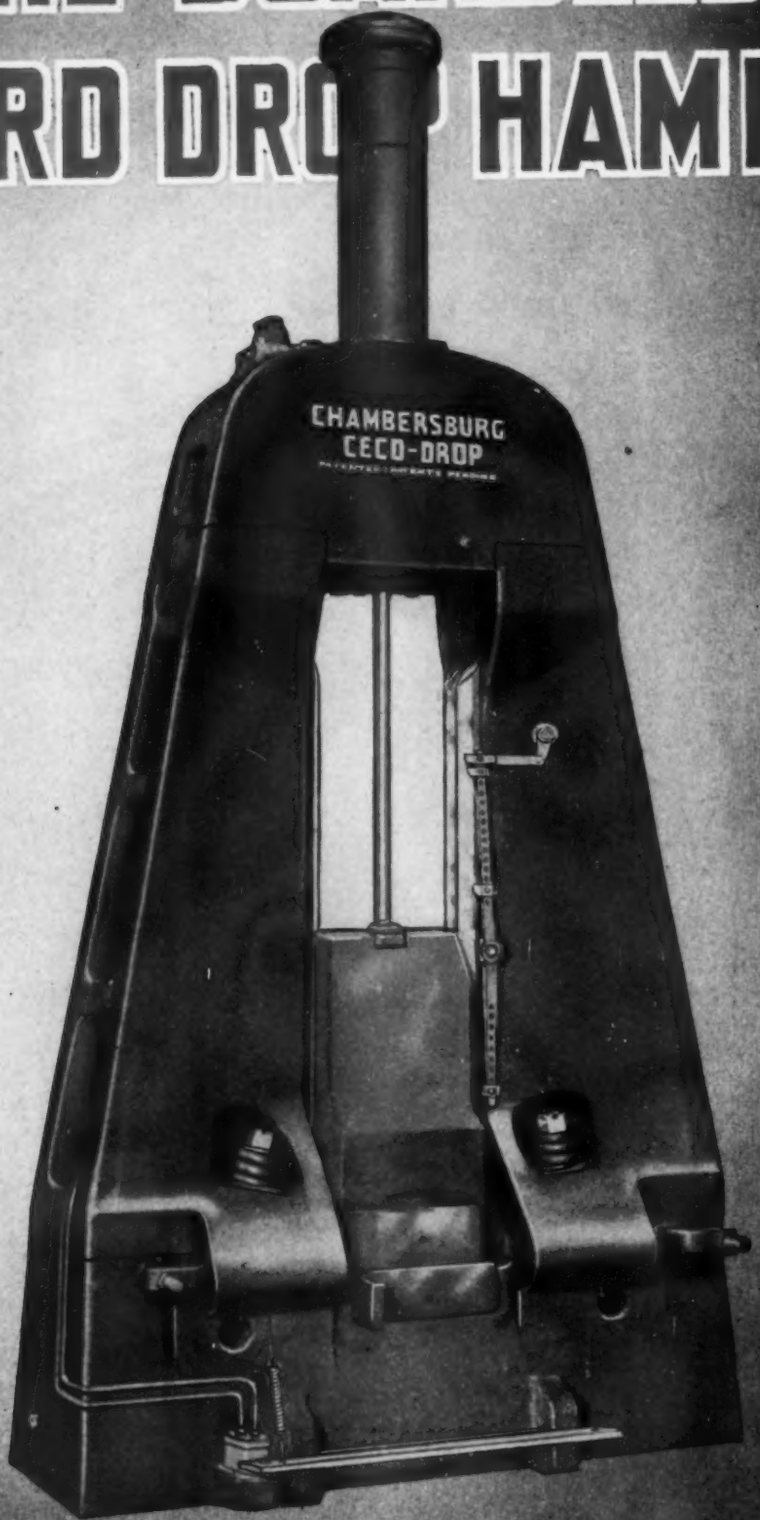
BRIEF JOB FACTS

Part — 28 Tooth Transmission Gear — 5 D.P., 20° 52' Helix Angle, 6.318" x 2¼" face.
Material — SAE 4620 Steel, R. C. 25-29, machinability rating 50-65%.
Feed — .070" per rev. of work *Hob Speed* — 88 R.P.M.
Cutting Time — 26 min. per load of 2 gears.
Hob Life — 24 gears per sharpening

Barber-Colman Company

GENERAL OFFICES AND PLANT 111 LOOMIS ST. ROCKFORD, ILL. U.S.A.

THE BOARDLESS "BOARD DROP HAMMER"



NO BOARDS · NO BELTS · NO MOTORS

NEW!

Announcing the CHAMBERSBURG

CECO-DROP

REG. U. S. PAT. OFF.

CHAMBERSBURG Engineering Company marks its 50th Anniversary with the introduction of a new gravity drop hammer that represents a tremendous advance in drop forging practice. Designed for work customarily assigned to the board drop hammer, the CECO-DROP will outproduce any existing gravity drop hammer.

Eliminating boards, the CECO-DROP lifts the ram by means of air or steam, holds it by a simple ingenious clamp and drops it by an air valve operated by foot treadle. Performance records to date show at least 10% more forgings than on conventional gravity drop hammers, with simplicity, safety and low maintenance as additional features.

Write for descriptive bulletin

CHAMBERSBURG ENGINEERING COMPANY
Chambersburg, Pa.

CHAMBERSBURG
Builders of IMPACT *Machinery*

1897 · Fiftieth Anniversary · 1947

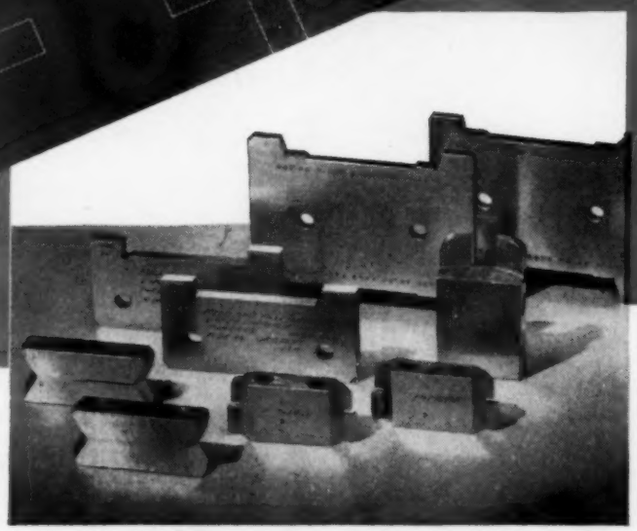
Get SMOOTH SURFACES for Accurate Layout Work

...USE

SIMONDS

"RED STREAK" Precision-Finished

FLAT GROUND STOCK



MAKE YOUR OWN GAUGES, dies, jigs, templates, stamps, shims, machine parts and small tools . . . with Simonds Oil Hardening Flat Stock, made of Simonds own alloy tool steel, uniformly annealed for easy machining and proper hardening.

SAVE TIME AND MONEY with this Flat Stock which is cut to 18" length and accurately ground to standard thicknesses and widths. *No need for the expensive machining required to grind ordinary stock to size.*

145 STOCK SIZES . . . special sizes to order. Get "Red Streak" Flat Ground Stock from your Simonds distributor, or the nearest Simonds office. Immediate delivery from stock on most sizes.

SIMONDS
SAW AND STEEL CO.
FITCHBURG, MASS.

Other Divisions of SIMONDS SAW AND STEEL CO. making Quality Products for Industry

SIMONDS STEEL MILLS — SIMONDS SAW AND STEEL CO. LOCKPORT, N.Y. — *Special Electric Furnace Steels*

SIMONDS ABRASIVE CO. PHILADELPHIA, PA. — *Grinding Wheels and Grains*

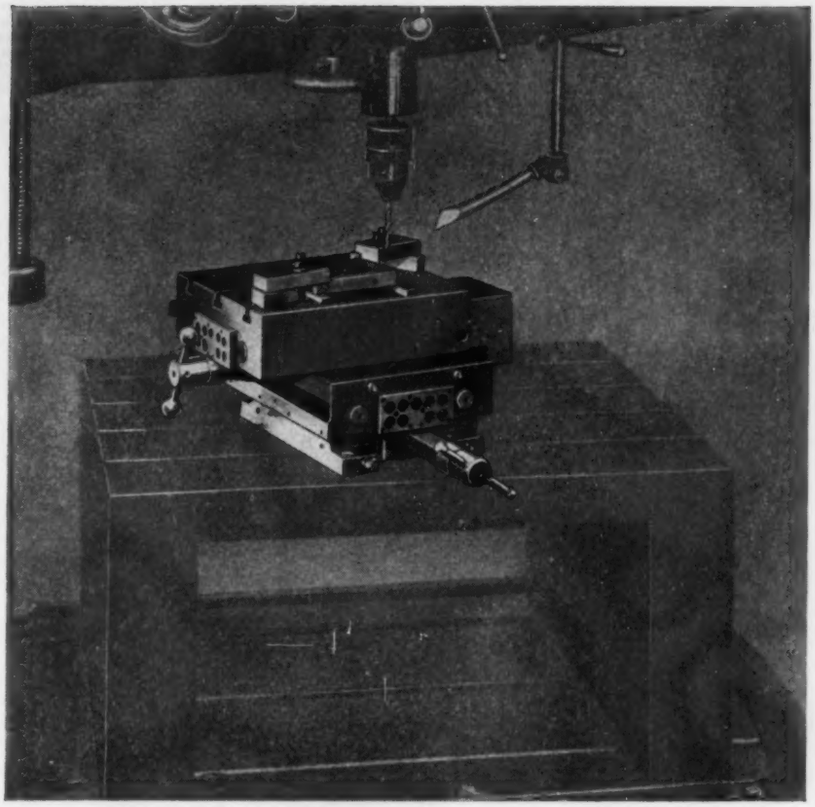
SIMONDS CANADA SAW CO. LTD. MONTREAL TORONTO VANCOUVER SAINT JOHN, N.B. — *Simonds Products for Canada*

BRANCH OFFICES: 1350 Columbia Road, Boston 27, Mass.; 127 S. Green St., Chicago 7, Ill.; 416 W. Eighth St., Los Angeles 14, Calif.; 228 First St., San Francisco 5, Calif.; 311 S. W. First Avenue, Portland 4, Ore.; 31 W. Trent Ave., Spokane 8, Wash. *Canadian Factory:* 595 St. Remi St., Montreal 30, Que.

NOW...

without JIGS

. . . . you can drill, bore, ream and tap . . . small work

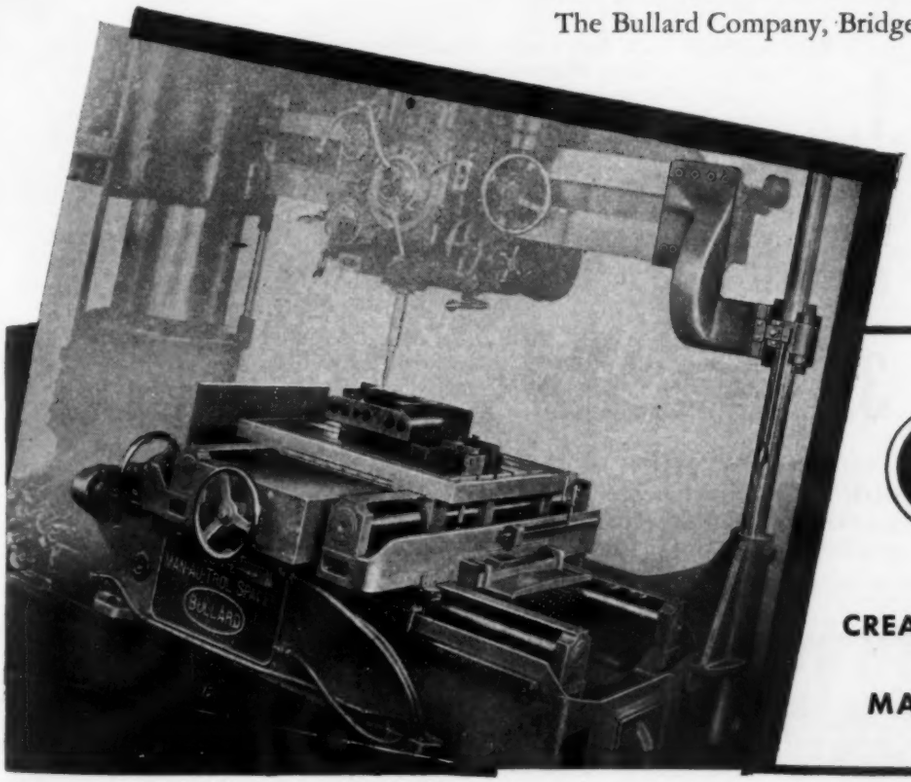


The new 4″x 4″ Bullard MAN-AU-TROL Spacer for speedily and accurately locating holes within a 4″x 4″ area . . . for use on smaller sensitive drills but usable on larger drills as shown. Its hydraulic unit will operate four 4″x 4″ Spacers if you so desire.

. . . as well as LARGE WORK

The new 30″x 20″ Bullard MAN-AU-TROL Spacer for accurately repeating a pattern of holes within a 30″x 20″ area . . . for use on radial drills.

BOTH the 4″x 4″ and 30″x 20″ Bullard MAN-AU-TROL Spacers give you such benefits as: elimination of expensive jigs . . . no production tie-ups for making jigs . . . straight holes 90° to the work . . . prevention of strain on drill spindle and reduction of drill wear because of perfect tool centering . . . less operator fatigue. Write for MAN-AU-TROL Spacer Bulletin. The Bullard Company, Bridgeport 2, Connecticut.

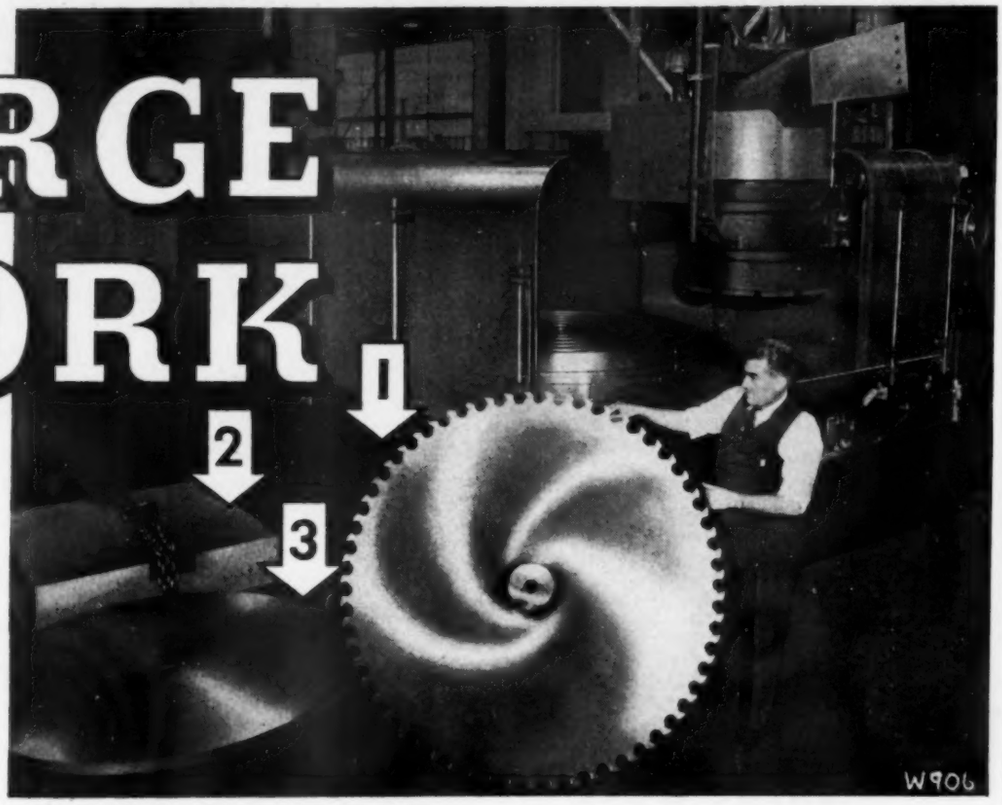


Typical Installation of 30″x 20″ MAN-AU-TROL Spacer.

BULLARD

CREATES *NEW METHODS* TO MAKE MACHINES DO MORE

for LOW-COST GRINDING of LARGE WORK



THIS largest of the BLANCHARD Grinders can handle work up to 84 inches in diameter and 18 inches thick. It is made with several sizes of grinding wheel from 27″ to 42″; and with a 48″ or 60″ magnetic chuck, to which a non-magnetic extension ring may be added, increasing diameter to 84″.

Like all BLANCHARDS, this is an extremely versatile grinder, as shown by the following examples:

1. THE 60-INCH SAW has a raised flat collar at the center on each side, making four surfaces to grind on each saw. The surface from the edge of the collar to teeth is tapered .028″ by tilting the wheel spindle slightly from the vertical. Stock removal per surface is .010″-.030″, to a tolerance of ±.002″. Twenty-eight cubic inches of metal are removed to finish grind one saw every 55 minutes.

2. THE STEEL DIE MOUNTING PLATE (48″ square x 10″ thick) has approximately 1/32″ removed from each side to a limit of .001″ flatness and parallelism. Total stock removal is 116 cubic inches. Floor-to-floor time is 1 hour and 35 minutes.

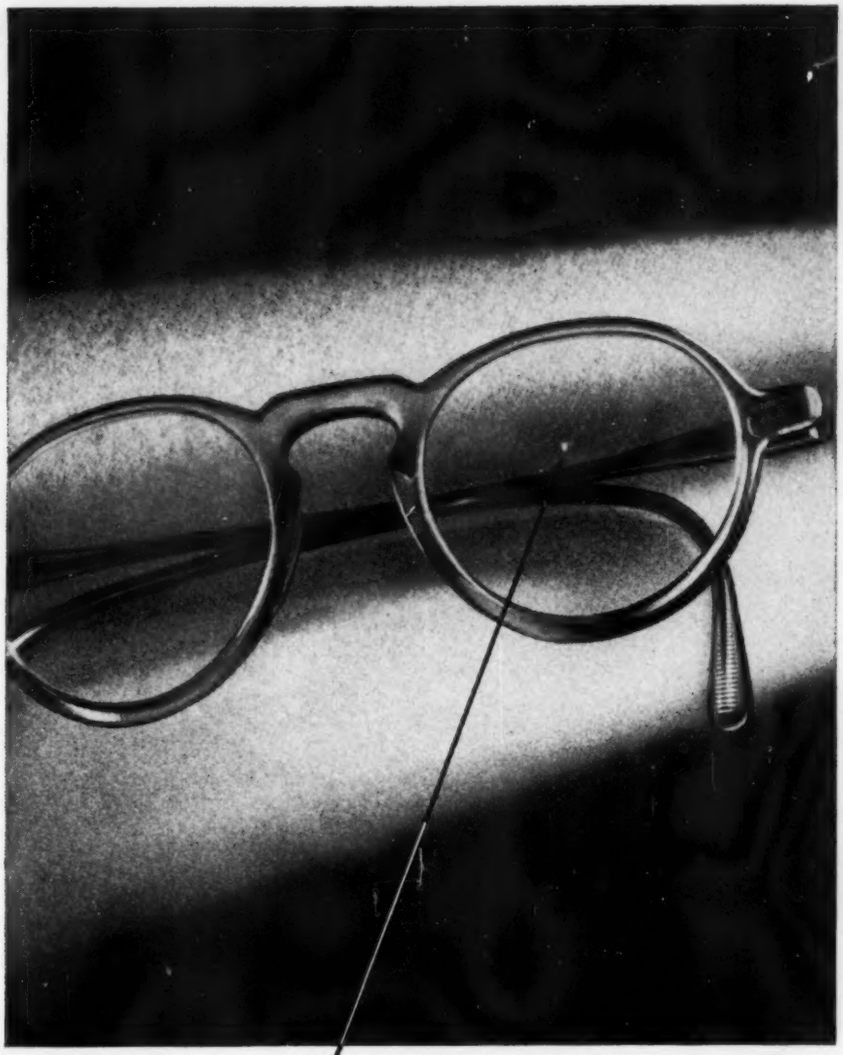
3. THE CAST IRON BOTTOM PLATE (60″ dia. x 2″ thick) is ground flat (on one side) within .0005″. The surface finish is such as to make a metal-to-metal watertight joint. Average stock removal is 1/64″, 44 cubic inches and floor-to-floor time is 50 minutes.

IF YOU MACHINE FLAT SURFACES . . . large or small . . . with or without projections . . . we'll be pleased to study your problems, suggest solutions, grind samples, and give you reliable production data . . . all without any obligation on your part.

BLANCHARD

The BLANCHARD MACHINE COMPANY
64 STATE STREET, CAMBRIDGE 39, MASS., U. S. A.

Safety Goggles Win High Praise from Gem Safety Razor Corporation



"This A-O Goggle saved the eye and possibly the life of E. Steller of the Brush Department. This chip in the lens was caused by the tool-bit he holds in his hand."

Typical records reveal that eye injuries cost (in first aid attention, idle machine charges, unproductive time and other frequently "hidden costs") $14.60 per injured man per year. Yet 98% of these accidents (according to the verified figures of the National Society for the Prevention of Blindness) are *avoidable*—mainly through the use of Safety Goggles.

Can you afford to overlook this opportunity to lower your production costs?

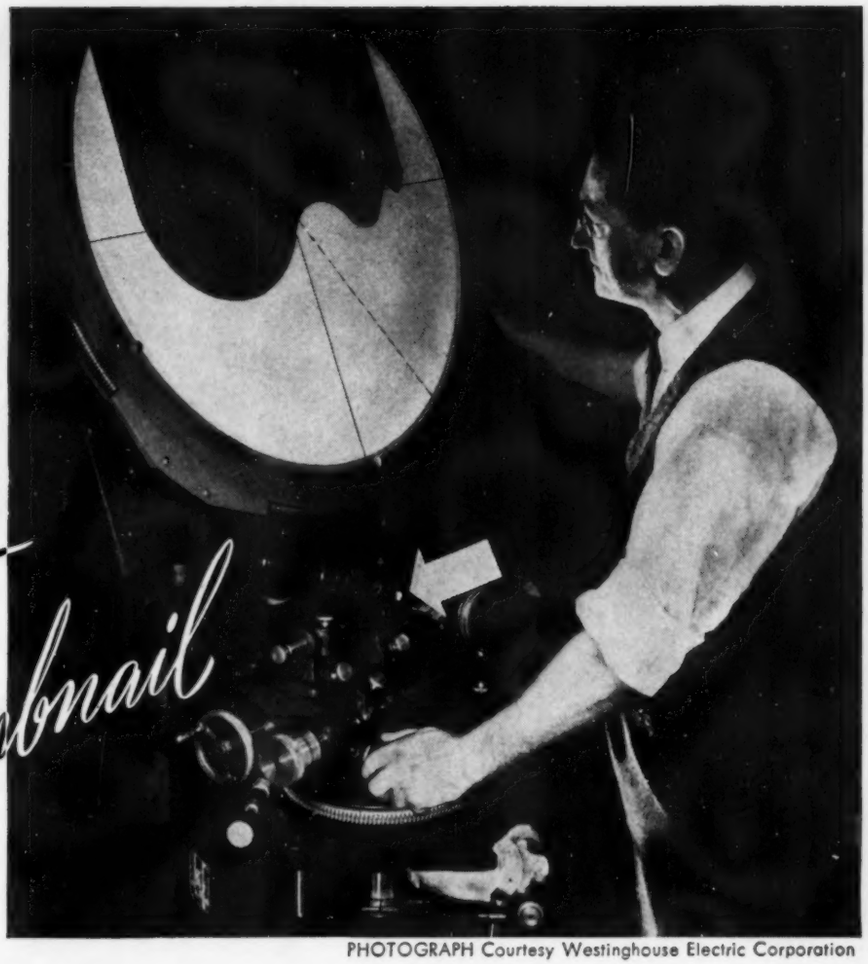
Send to your nearest A-O Safety Representative or direct to American Optical Company, Box A for a copy of the new book, "Eye Accident Costs," telling how to prevent them and how much you can save by preventing them.

American Optical
COMPANY
Safety Division

SOUTHBRIDGE, MASSACHUSETTS
BRANCHES IN PRINCIPAL CITIES

Blueprints for 2 billion men—in a thimble.*
One reason why a scientist believes in God is because the special tools and the individual characteristics which make every animal, plant and man distinct from every other in the world can be no accident. Divine imagination deposited a controlling design for each in the genes that are found in every living cell.
Your success in research, product design, production, and marketing is likewise no accident. It is the product of plans blueprinted by your imagination and the superior imaginations you hire.
Vulcan offers for hire a superior tool-designing imagination. This has been sharpened by 30 years of experience with the varied problems of diversified industries. Thus Vulcan offers what no captive toolroom can ever have—an imaginative spark intensified by constant stimulating contacts with the highest voltage tool engineering minds from every major industry.
*In "Why a Scientist Believes in God" (Reader's Digest, December, 1946) the author says the genes of all people in the world would only fill a thimble.
THE VULCAN TOOL CO.
730 LORAIN AVE., DAYTON 10, OHIO
ENGINEERING • PROCESSING • DESIGNING • BUILDING
SPECIAL TOOL AND MACHINERY MANUFACTURING
METAL WORKING
REACTOS
Lew Currier

SMALLER THAN A *Thumbnail*



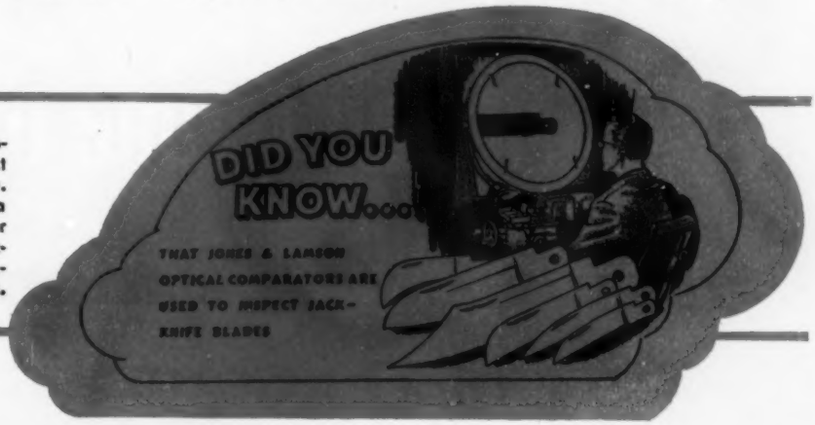
PHOTOGRAPH Courtesy Westinghouse Electric Corporation

CHECKING a thread gage smaller than a thumbnail is simple when a Jones & Lamson Optical Comparator is used. The enlarged shadow of the gage projected upon the screen allows its contours to be examined for absolute accuracy, quickly and easily.

Jones & Lamson Optical Comparators provide a rapid and extremely accurate method for inspecting even the most complex forms.

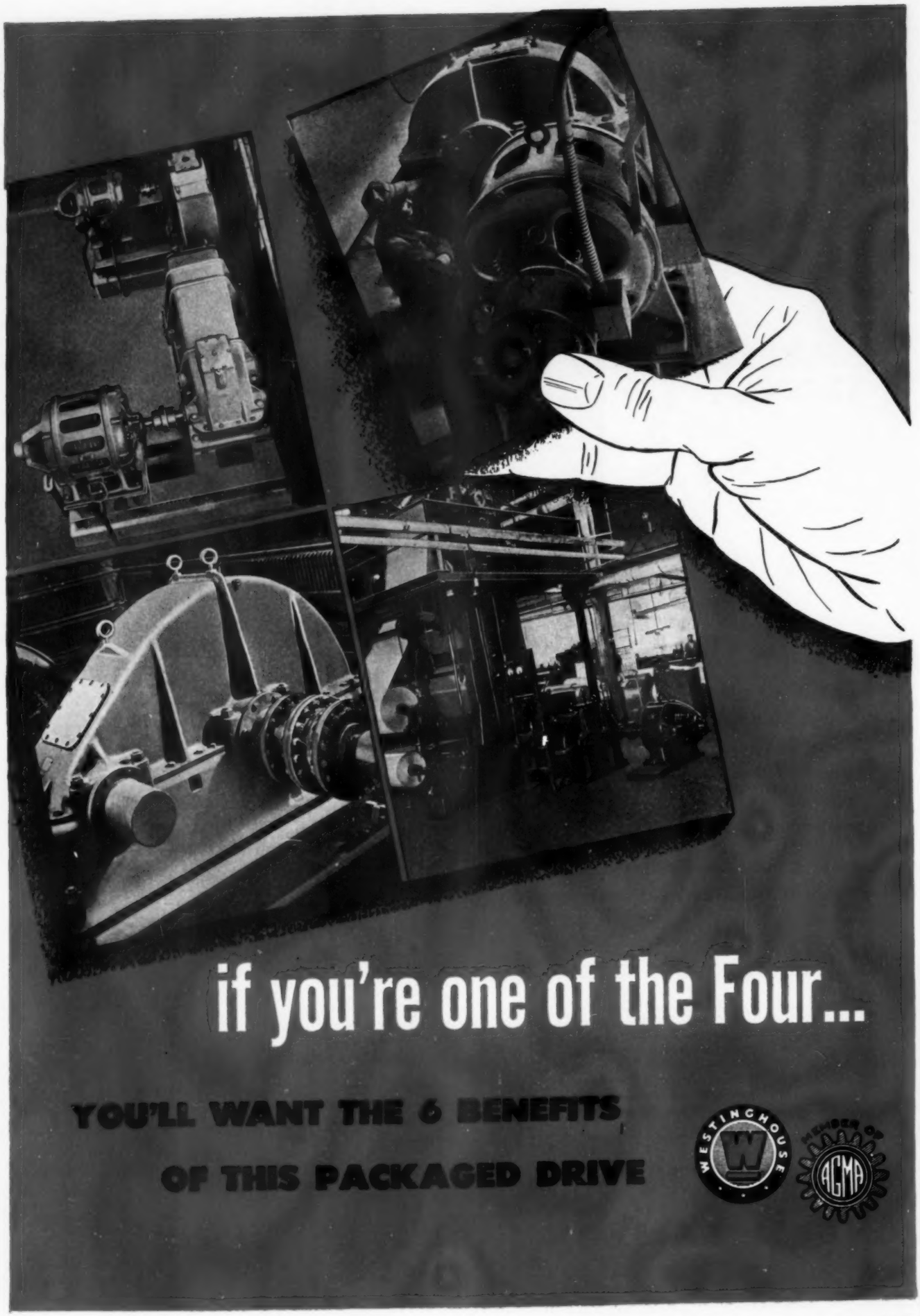
Our engineers are inspection specialists, their knowledge of holding fixtures, handling methods and suitable Comparator equipment has saved thousands of dollars in manufacturing plants throughout the country. Call, write or wire for their service today.

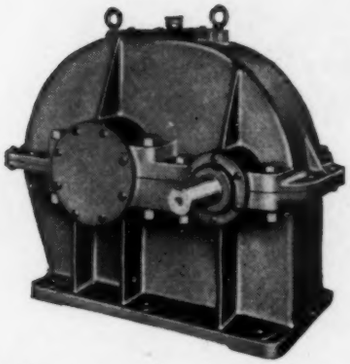
Probably a Jones & Lamson Optical Comparator could effect comparable savings for you. Write for our book, "Beyond a Shadow of a Doubt." Or, better still, ask for one of our inspection engineers to call and discuss your inspection problems.



JONES & LAMSON
MACHINE COMPANY
Springfield, Vermont, U.S.A.

Manufacturer of: Universal Turret Lathes • Fay Automatic Lathes • Automatic Double-End Milling and Centering Machines • Automatic Thread Grinders • Optical Comparators • Automatic Opening Threading Dies and Chasers • Ground Thread Flat Rolling Dies


if you're one of the Four...
YOU'LL WANT THE 6 BENEFITS
OF THIS PACKAGED DRIVE
WESTINGHOUSE
MEMBER OF
AGMA



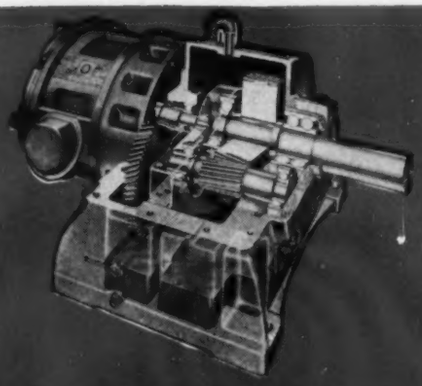
This Type SH speed reducer is a single-reduction unit which is furnished in thirteen standard ratios in each of twelve sizes. The Type DH speed reducer, which is a double-reduction unit, is offered in fifteen standard ratios in each of twelve sizes.

If your machines are among the four out of five that run slower than their prime movers, here are six ways you can profit by using Westinghouse speed reducers:

1. Improved power efficiency (one plant raised it from 80.9% to 85.4%).
2. Fewer inspections . . . only semiannual lubrication needed.
3. Maintain positive alignment of drive and driven machine.
4. Long service life through single helical gearing, specially heat-treated by exclusive Westinghouse BPT process.
5. Minimum power loss with antifriction bearings.
6. Precision operation from hot-cut gears.

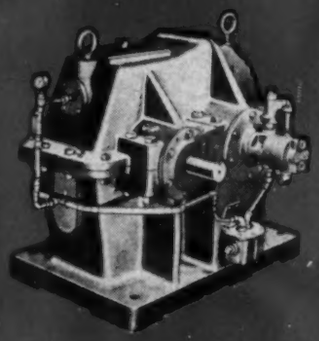
Add to these benefits the advantage of unit responsibility with both motors and gear supplied by one manufacturer. You have your choice of twenty-four sizes of Westinghouse speed reducers—Types SH and DH—for drives up to 1,000 hp with speed reduction ratios of 2.82 to 70.5.

Write, wire or telephone to your nearest Westinghouse office today, for full information on the application of speed reducers to your own drives. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna. J-07252



FOR DRIVES FROM 1 TO 75 HP CHOOSE GEARMOTORS

Within the standard listed range of 1 to 75 hp ratings, you get the best in speed reduction with Westinghouse gearmotors. Three types—A, C and E—are available and provide output speeds from 1,440 to 16.5 rpm. All unit types can be used with either single-phase, polyphase or d-c motors.



USE THESE HIGH-SPEED UNITS UP TO 2,000 HP AND 9,000 RPM

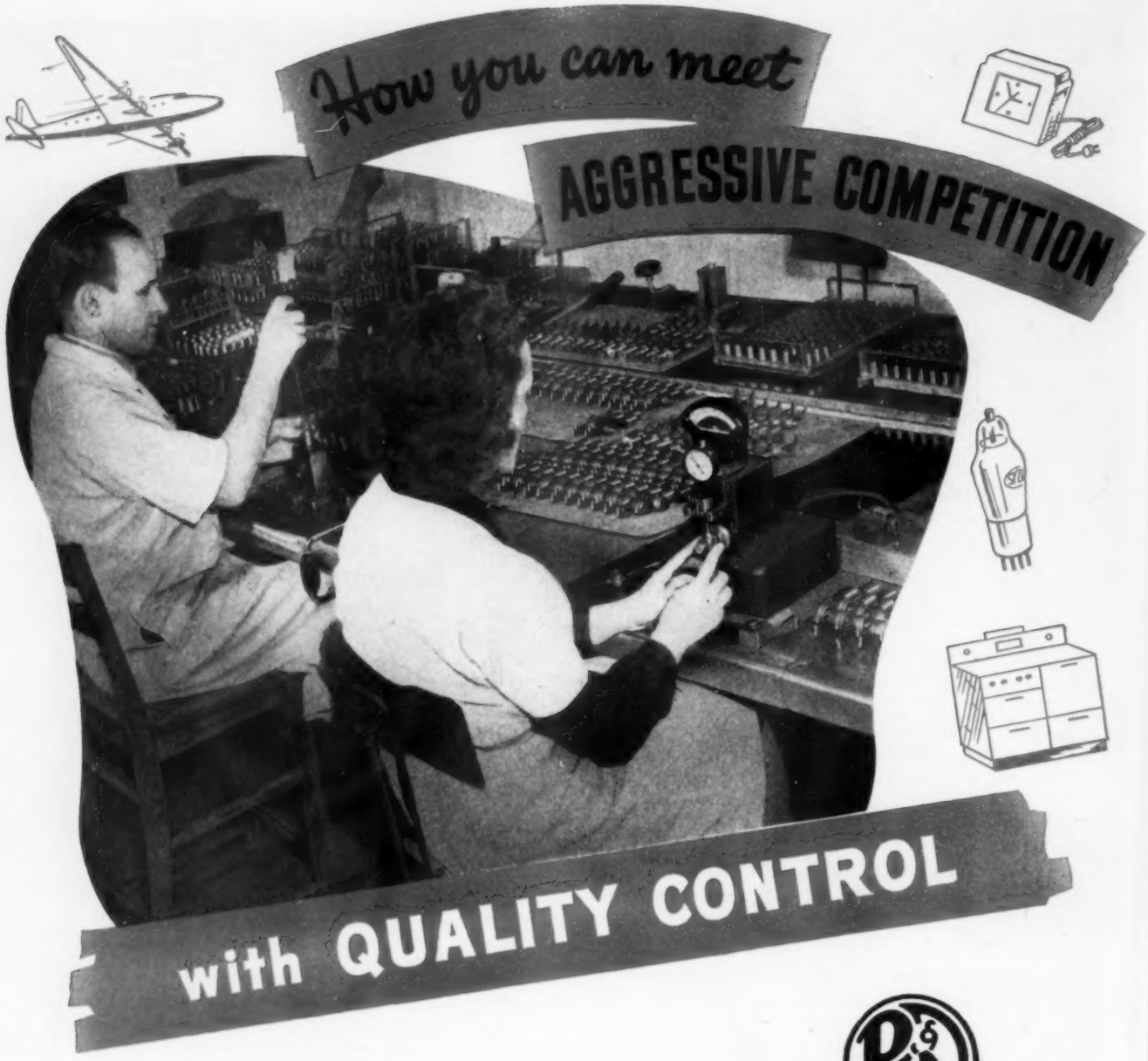
These Westinghouse Type SU units are specially designed for high-speed duty in speed increasing services for pumps, compressors and similar applications. Units are available in 30 sizes—with gear ratios from 1.25 to 3.25 up to 2 to 12.

You'll find all the facts on industrial geared drives in this new, picture-packed book. Ask for your copy of B-3730 today, on your business letterhead, please.

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

4 out of 5 drives need speed reduction



The victors in the battle for manufacturing survival during the coming critical competition will be using Quality Control. It is a system that greatly steps up manufacturing quality and efficiency . . . which in turn is the only way to offset high material and labor costs.

Quality Control is a system which includes precision gaging to maintain design tolerances through every step of manufacture and assembly. It is based on carefully engineered precision comparator gages and a method of "production bookkeeping" control cards. It results in the smoothest, most precise and economical product assembly that has ever been known. It is welcomed by management and labor alike, because it is excellent insurance against "red ink" operation. And that means job security for the American workman instead of "apple selling" if losses close up his company.

Pratt & Whitney engineers are experts on the gages that are a vital part of Quality Control. Call them in to collaborate on your production problems. It pays dividends.

Send for the P&W Condensed Catalogue which shows you the many ways that P&W accuracy can help you meet and beat competition.

Pratt & Whitney

Division Niles-Bement-Pond Company

West Hartford 1, Connecticut

If so, Insist on *CONTINENTAL* Broaches

Broaching may give you unusual opportunities for increasing production, reducing unit cost, holding closer tolerances, and improving finish . . . *all necessary to manufacture successfully in 1947!*

Continental Tool Works is a leader in the field of broaching, a process now widely used throughout the metal-working industry as one of the fastest methods to remove stock to precision limits.

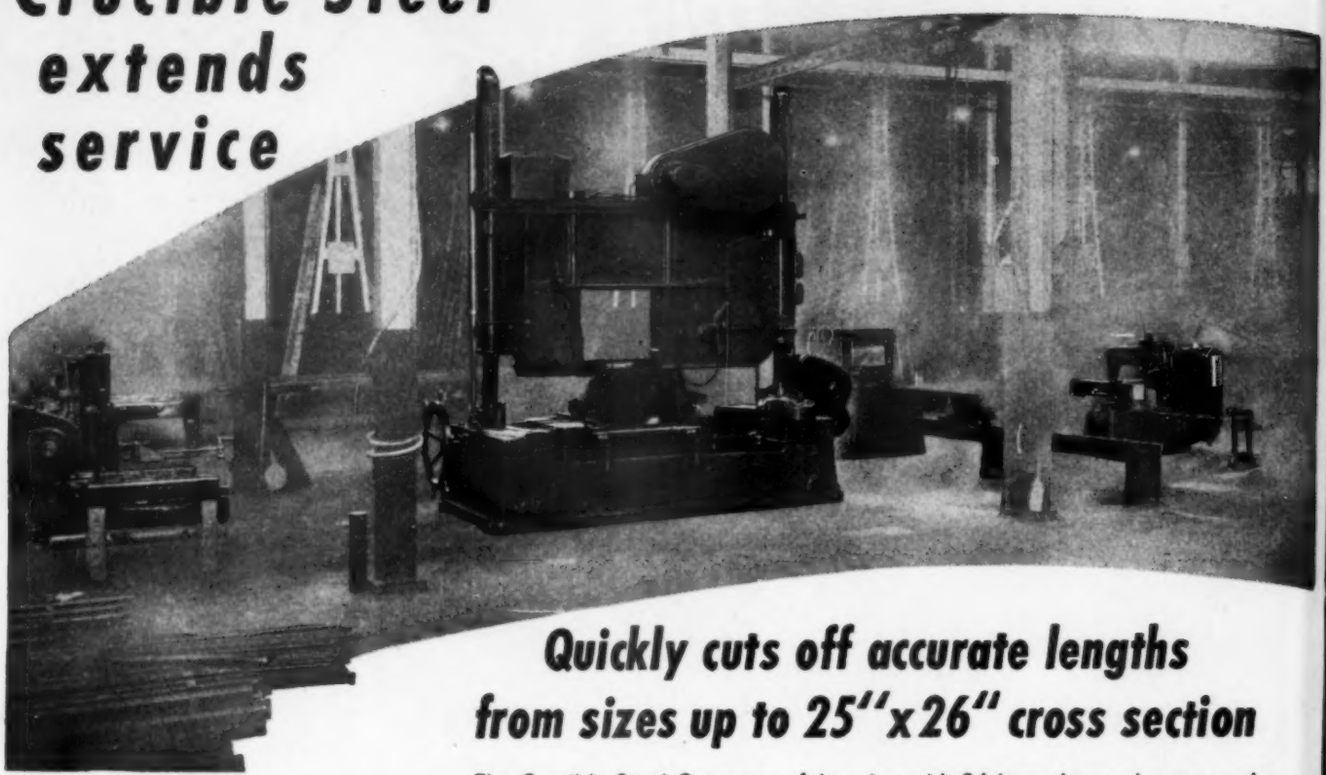
Continental broaches are ground by skilled broach-makers to exceedingly close tolerances. Extreme care in design and workmanship insures that each Continental broach is fitted exactly for the job it is intended to do. These are reasons why Continental-made broaches produce more parts per grind, more grinds per broach. Write to Continental today for folder No. 12791, *"Problems Solved By Broaching."*

CONTINENTAL TOOL WORKS
CTW
EX-CELL-O CORPORATION

CONTINENTAL TOOL WORKS
DIVISION OF EX-CELL-O CORPORATION
DETROIT 6, MICHIGAN

47—6

Crucible Steel extends service



Quickly cuts off accurate lengths from sizes up to 25"x26" cross section

The Crucible Steel Company of America with 26 branch warehouses and sales offices, has built a reputation for anticipating customers' needs, not only in high grade and special steels, but in service requirements as well. They were among the first to equip several of their warehouses with modern high speed MARVEL Saws (No. 6 and 9A series) in order to give fast service on either single lengths or large quantities of identical pieces, accurately cut from bars up to 10" x 10" cross section. Now in anticipation of new demands for larger sizes, they are the first steel company to install a No. 24 MARVEL Hydraulic Hack Saw in order to give fast service on orders for steels of any type *in sizes up to* 25" x 26" cross section.

This giant hack saw, which almost qualified as a "secret weapon" because it contributed so materially to our production capacity in building naval ordnance, applies an entirely new principle of reciprocation that has made "hacksawing" of large work practical for the first time.

Whatever your metal sawing problems, there is a MARVEL Saw exactly suited to your needs. A MARVEL field engineer will be glad to go over your metal sawing problems with you.

No. 24 MARVEL giant Hydraulic Hack Saw. (capacity 24" x 24"). Employs new "Roll Stroke" sawing action and trouble-free low pressure hydraulic control.

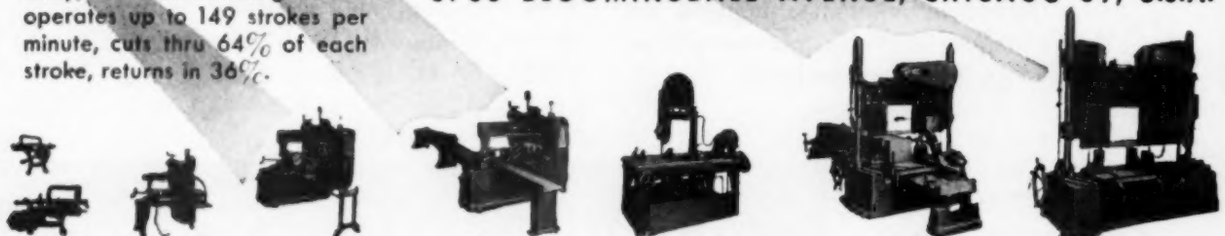
No. 9A MARVEL Production Saw (capacity 10" x 10"). Automatically feeds, measures and cuts-off identical lengths from single or nested bars with no more operator attention than an automatic screw machine.

No. 6 MARVEL Saw (capacity 6" x 6"). A high-speed, heavy-duty, all-ball-bearing saw—operates up to 149 strokes per minute, cuts thru 64% of each stroke, returns in 36%.

ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

5700 BLOOMINGDALE AVENUE, CHICAGO 39, U.S.A.



No. 1, No. 2 Series Capacity: 4"x4" Capacity: 6"x6" | No. 4B Series Capacity: 6"x6" | No. 6 Series Capacity: 6"x6" | No. 9A Series Capacity: 10"x10" | No. 8 Series Capacity: 18"x18" | No. 18 Series Capacity: 18"x18" | No. 24 Series Capacity: 24"x24"

MARVEL SAWS

Four Modern Plants

WYCKOFF

- BARS
- TURNED AND POLISHED SHAFTING
- WIDE FLATS Up to 12" x 2"
- SPECIAL SHAPES
- TURNED AND GROUND SHAFTING

Kirsten

BROADCHED BY ★ American

Accuracy and smooth finish are required for the holes in Kirsten pipe radiators and cigarette holder bodies. Close tolerances are needed to fit the arbor for subsequent milling operations on the stem exteriors. Smooth finish is likewise important on inner bores. All these specifications—*plus* an extremely high rate of production—are met in broaching by *American*.

Kirsten master mechanics use the popular *American* T-4 type Broaching Machine, one more example of the many ways in which broaching by *American* can be applied to a wide range of metal working problems.

FOR ALL YOUR BROACHING NEEDS
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Illustration shows *American* Hydraulic T-4-24 Broaching Machine tooled for broaching cigarette holders and pipe radiator stems.

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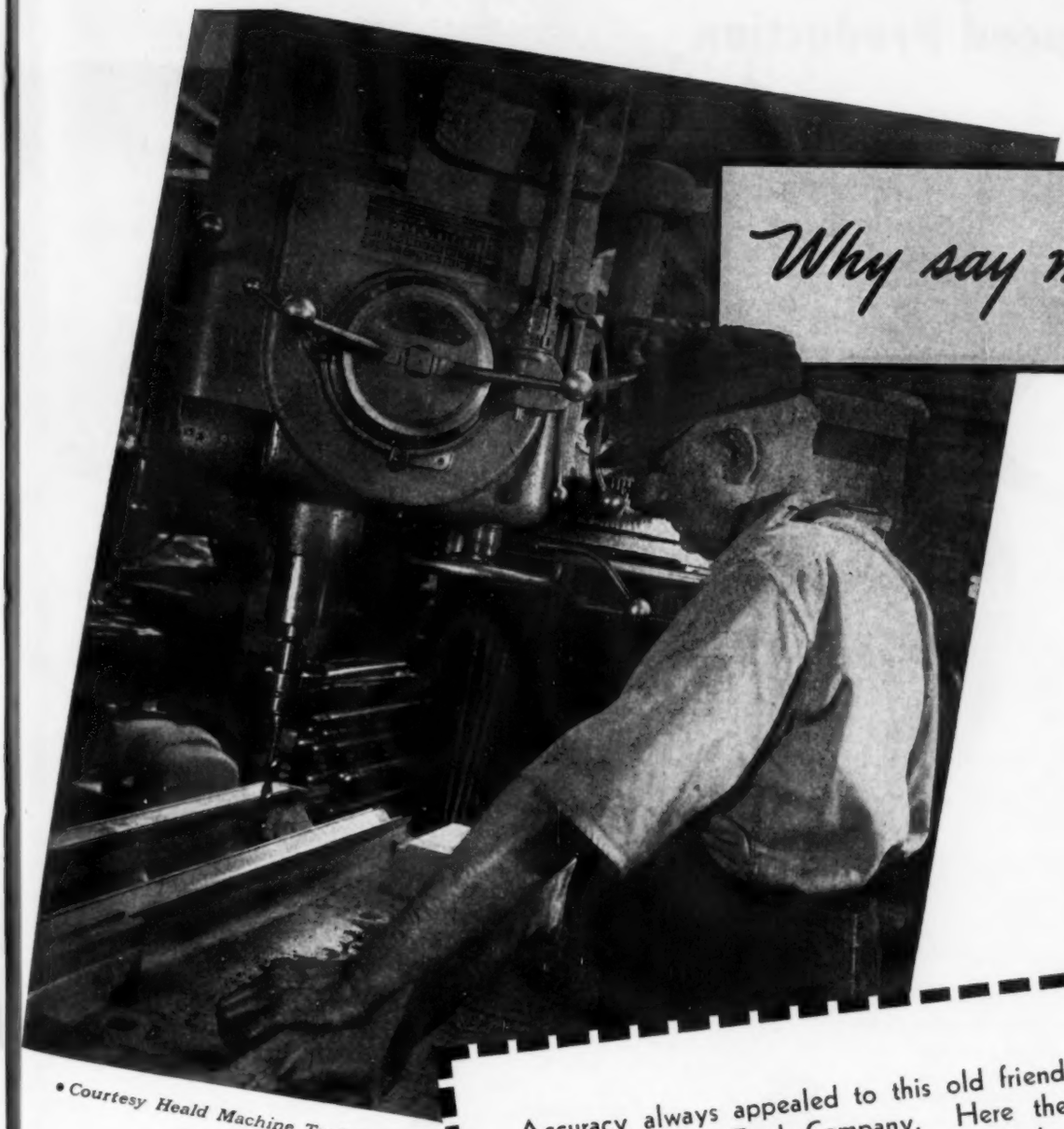

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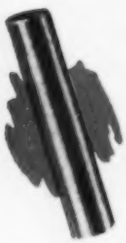

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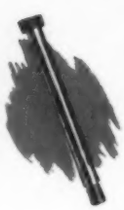

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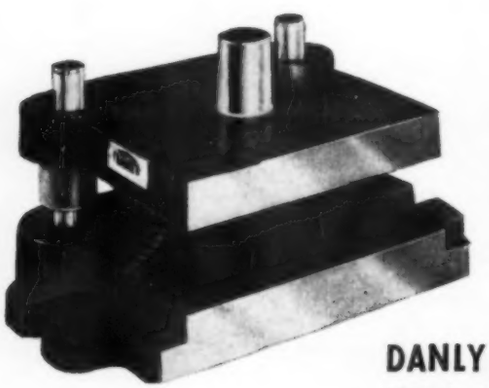

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Danly Tool, Die and Gage Makers' Supplies

American Machinist's Spot NEWS OF METALWORKING

Fuel shortage is so acute in British Isles that 30% of metalworking industries in London area are temporarily shut down. Idleness has extended to Birmingham industrial district.

Progress in drafting master national industrial mobilization plan for industry is ahead of schedule, but suggestions to Congress on legislation to back up program for standby plants and for skeletal industrial operations and for rapid switchover from peacetime to wartime footing won't be ready until 1948. Army & Navy Munitions Board intends to set up 25 industrial advisory committees to keep their own industries advised of changes in military requirements.

Chinese are becoming interested in rubber cushion dies used extensively in the aircraft industry for a number of years. These dies might fit in well with Chinese limited-scale production.

U. S. purchasers are being permitted to buy war surplus materials in foreign depots and ship them back here, according to ruling of State Department's foreign liquidation commission. Agricultural and construction machinery is reported coming in at a brisk rate.

Chromium-plated aluminum is expected to appear soon to compete with other materials and processes for such uses as automobile bumpers and radiator grilles.

Ferguson Tractor will need $2 million of tools, jigs and fixtures before starting operations in Cleveland. Ford has kept all tools and fixtures used in turning out Ferguson tractors.

Some $18 million for stainless steel equipment will be spent by one company in expanding facilities for making synthetic hosiery. Total expenditures will be $300 million during next three years.

1947 Machine Tool Show will be held at Dodge-Chicago plant in Chicago September 17-26. It will have over 250 exhibits, will occupy 500,000 sq.ft., will be largest industry exposition ever held. Theme will be "more goods for more people at lower prices." Admission will be by invitation, with advance registration. Show will be open 10 a.m. to 5 p.m. with technical sessions of Machine Tool Congress in evenings.

Nineteenth V2 rocket fired by Army Ordnance at White Sands, N. M., was first to have American-made machinery or instruments vital to the rocket's operation. Ultimate aim is to develop new techniques to control rocket's flight from ground by radio.

Source of black market steel, for which brokers are getting as much as 400% of mill prices, is mystery. One report is that brokers buy steel from unbalanced inventories of firms which got preferential treatment in government allocations. Steel shipments from small mills, tagged for export, are believed to be showing up in domestic black market.

British are importing fissionable materials for atomic pile to drive electric power plants. One atom plant is expected to save 5 million tons of coal and generate 1 million kw. of power.

About 15,000 surplus general-purpose machine tools and other metalworking equipment are being processed for extended storage by Army Air Force at former Glenn Martin plant at Omaha, Neb.

Ford is reported planning to get a pilot line for a new car set up and operating in April, with objective of producing new models by late summer or early fall. Ford has transferred all truck production to Highland Park. New truck assembly line is 1400 ft. long, will handle 43 models.

Government operations in atomic industry should be turned over to private industry as soon as possible, declares David Lilienthal, nominated chairman of Atomic Energy Commission.

(Further news on pages 149-160)

PREVENT RUST!

The hydraulic system of a broaching machine operating 22 hours a day had to be dismantled every two weeks to clean rust and deposits from pistons and valves in order to get the machine to run smoothly and with the proper speed. After changing to Texaco Regal Oil (R & O) the same machine ran for 90 days between drain periods with no indication of trouble.

A machine tool manufacturer found, when operating one of his machines continuously day in and day out with a turbine grade mineral oil, that sludging of the hydraulic system resulted after 500-700 hours of operation. By switching to Texaco Regal Oil (R & O) he was able to increase the period between drains to 2400 hours, with no sign of gum, sludge or varnish.

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The rust inhibitor in *Texaco Regal Oils (R & O)* "plates" all parts of the hydraulic system so that moisture cannot reach and rust the metal. The oxidation inhibitor aids the oil in freeing itself rapidly of air and water and thus prevents sludge formation. In addition, *Regal Oils (R & O)* will not foam — extra assurance of smooth, dependable operation.

Leading makers of hydraulic equipment either ship their units filled with *Texaco Regal Oils (R & O)* or recommend their use. There is a complete viscosity range to assure trouble-free, economical performance from every hydraulic mechanism, large or small.

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American Machinist

MAGAZINE OF METALWORKING PRODUCTION ★ ESTABLISHED 1877

Confounding the Pessimists

A lot of pessimism was voiced in advance about 1947. Everything from a mild "bump" in business to a severe slump was predicted.

Yet, five weeks after the start of the year, the facts at hand serve to confound the pessimists.

Industrial production is displaying amazing vitality. It is considerably above that of a year ago, and surpasses the 1941 average by a healthy margin.

Employment is at a peacetime peak. The dire fears of what would happen in the labor market when 14 million men were discharged from the services have not been realized. No veterans are finding it necessary to sell apples.

A year and a half after the war's end, jobs are going begging all over the nation. Labor shortages are acute in a number of centers.

The steel and automobile industries, spotlighted as strikebound in '46, are showing signs of better labor relations. Both United States Steel and Chrysler have announced extension by union consent of contracts about to expire. Negotiators thus will have a chance to talk over at length and agree upon new contracts.

Contrasted with the belligerency exhibited a year ago, when strikes were called right and left, union leaders are displaying commendable restraint, partly prompted by the temper of Congress and of the people.

Prices, which have had everyone worried, finally are breaking here and there. Food prices in particular are trending downward. Clearance sales of various consumer goods have appeared for the first time since prewar days.

And Henry Ford II has challenged other industrialists to follow his company's lead in reducing prices.

The situation in raw materials and component parts is still far from good. But the supply is gradually increasing. As the year wears on, more and more steel and electric motors and bearings will be available to ease the shortages. The trend is in the right direction.

With labor's cooperation (which seems far more assured than it did even a month or two ago), industrial production will stay up on a high plateau. It may go even higher, especially in many metalworking lines.

The automobile industry, to name only one, is likely to turn out over 5 million cars and trucks this year. Only a few times previously have that many units been built in a single calendar year.

Other industries are promising to pour out their products at a startlingly high rate.

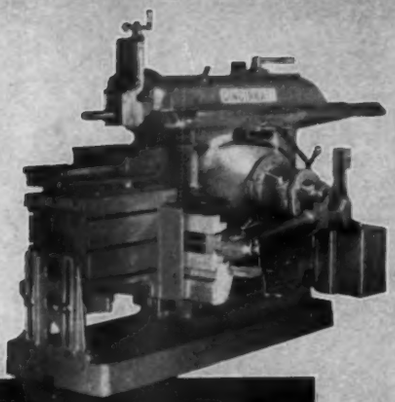
With high production and a Congress favoring a middle-of-the-road policy, the worst dangers of inflation should pass.

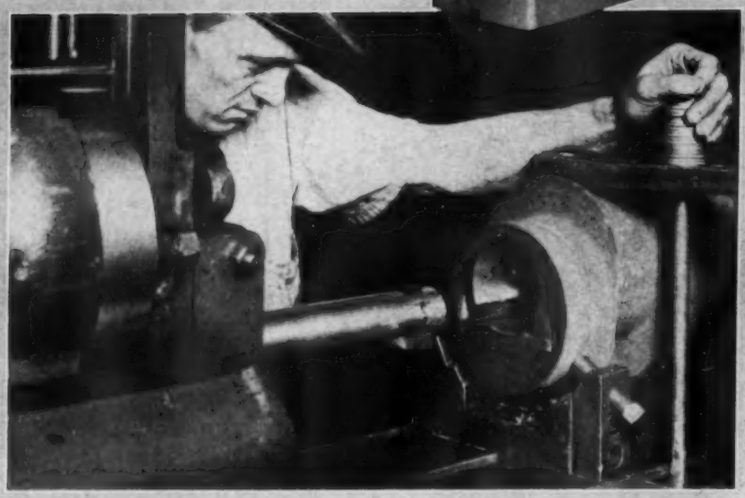
Before its life span ends, 1947 may run a business fever and cause some anxiety. But it certainly is starting out with a reassuring display of health and vigor. It is passing its first test with a very high score.

Burnham Finney

EDITOR

Use a SHAPER





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Write for Catalog N-3, and the practical Bulletin — Set-ups on Cincinnati Shapers.

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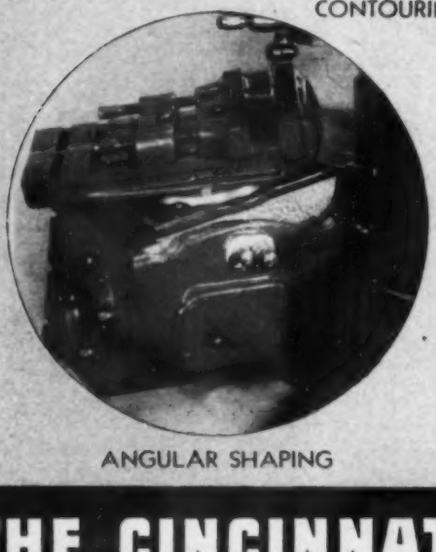
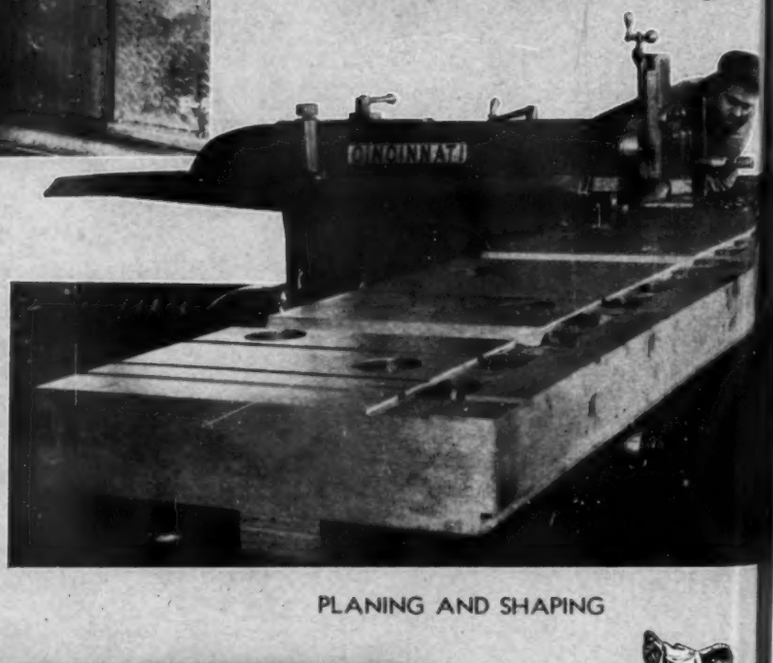


ANGULAR SHAPING



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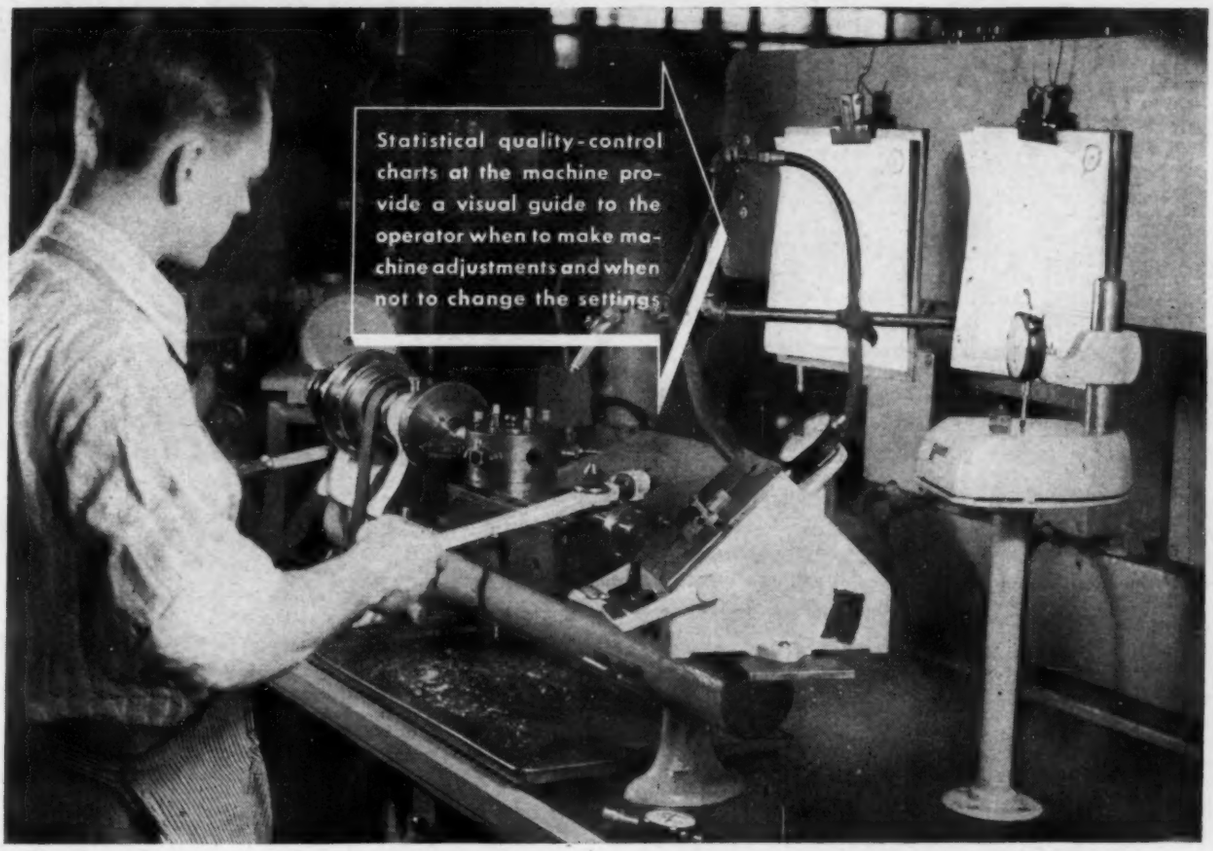

Statistical quality-control charts at the machine provide a visual guide to the operator when to make machine adjustments and when not to change the settings

Quality Control Aids Supervisors . . . 1

Fundamentals and Purposes

Quality-control engineers have been flooded with theoretical, mathematical discussions on statistical methods. But these have left the shop man in a daze. To explain basic principles and to help him interpret the charts, this series of articles is offered

BY DAVID T. ARMSTRONG

STATISTICAL quality control is not a new and mysterious something, like the Einstein theory of relativity, which only a gifted few are supposed to be able to comprehend.

Rather it is another application of the already familiar law of chance or probability so widely used by insurance companies in calculating premiums for life-insurance policies on the basis of the American Experience of Mortality Tables, or the method of figuring the amount and frequency of pension payments based on age of the pensioner and taking into account his probable life expectancy.

But to the man in the shop, the best known example is the game of rolling dice in which certain combinations such as 6, 7, and 8 occur quite frequently and 2, 3, 11 and 12 occur infrequently.

The world in which we live is a world of shades of difference between one thing and another with which any given one thing can be compared. For example, of the approximately 100,000 hairs on the average head, no two are exactly and precisely the same size, if we carry the decimal dimension to a sufficient number of places.

Likewise, in any production process it is not possible to make two

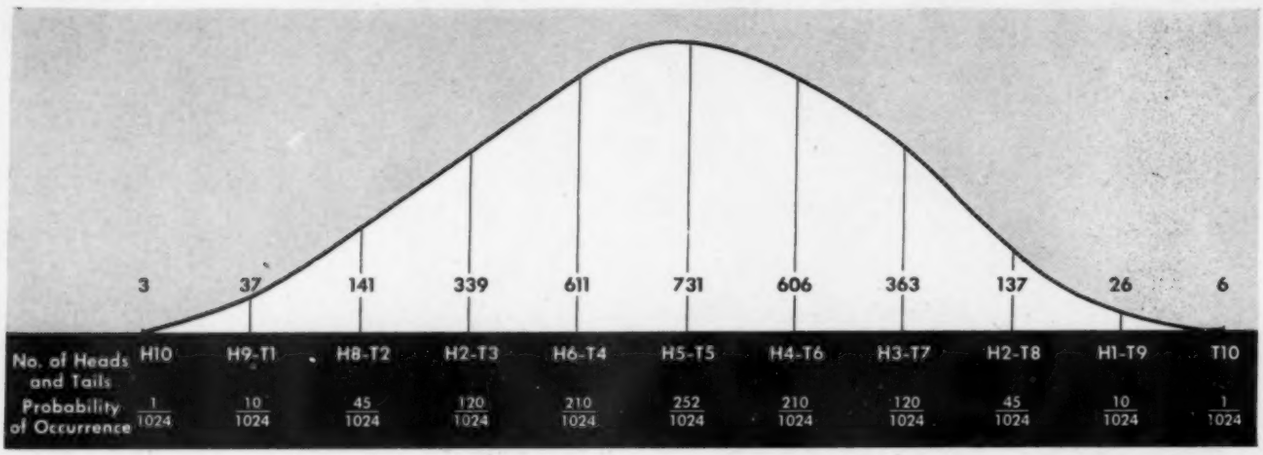


Fig. 1—Thirty individuals tossing 10 coins 100 times each and counting the heads gave this frequency curve. Probability of occurrence is shown by the 1024 ratios. Probability of all heads on ten tosses is $(1/2)^{10}$ or 1/1024. Probability of 5 heads and 5 tails is 252/1024 × 3000 = 738, as compared to an actual 731

things alike. It is possible only to make them nearly enough alike to be interchangeable in a given situation.

The job then which statistical quality control sets itself to do is to designate the limits within which parts may vary by small degrees from the accepted perfect and standard dimension and still be acceptable for the job they are intended to do. By use of the same mathematical principles and procedures the actuarial statistician employs, statistical quality control becomes a device that enables the inspector to estimate safe limits of variations on either side of the basic, or standard, dimension.

When the quality-control graph is set up, it provides a visual means of determining when the variations in piece size are going out of control because the graph indicates the trend of production.

Statistical quality control is also useful to engineers and designers because it supplies them with accurate information as to which tolerances should be established. Obviously, if machines are producing pieces with quality-control limits established at ±0.001 in., designers should, where possible, set tolerances at ±0.002 in. When quality-control limits are less than permissible overall tolerances, practically no reject pieces will be produced.

Establishment of a quality-control system does not necessarily mean that the extensive practical experience of a good workman is discarded in favor of mathematical computations based on inspection of arbitrary lot samples or that the inspector has degenerated into a mere pencil pusher.

As a matter of fact, the inspector will have less work to do, but that work must be of unusually high quality. The keenness, thoroughness and accuracy of his observations will be amplified by statistical formulas applied in such a way that careless measurements will destroy the accuracy and validity of a great deal of work. The statistical method is only as good as the intelligence and care exercised by the user of that method.

Failure or Success?

Competition today makes quality control one of the factors that may decide the difference in the narrow margin that spells failure or success This is not an idle statement. Absorption of additional labor costs by comparative reductions in processing costs makes it desirable to consider the economic advantages of establishing not only a quality-control system, but also a quality-control course in the cost-reduction training programs so widely sponsored for supervisory personnel.

In the past, some kind of quality control has always existed, but the kind to be advocated and described here is a scientifically accurate technique using statistical formulas to check the quality of a product during various stages of its manufacture.

Because many foremen and supervisors in industry today have had little opportunity to familiarize themselves with this comparatively new techinque, some discussion in simplified terms of the complicated mathematical formulas with simple examples may help to clarify a subject they must understand to operate their departments effectively and to cooperate with the quality-control staff. Basic principles should be understood by foremen and supervisors, even though they need not apply the mathematical formulas to arrive at numerical data that has quality-control significance.

The purpose, therefore, of this series of articles is to furnish the practical man in the shop with sufficient explanation to enable him to understand the general principles of quality control and to interpret the charts and graphs for the purpose of diagonstic, preventive and corrective machine-adjustment procedures.

Discussion of this subject should be preceded by a few definitions, including:

QUALITY CONTROL — A general term for the process of maintaining the quality of a manufactured product within prescribed limits, that is, producing machined pieces within permissible tolerances.

Quality control involves the care exercised over various operations before, during and after manufacturing processes. The purpose of quality control is to insure conformity of components of completed products to the specifications at the lowest possible production cost.

It involves utilization of testing and inspection techniques to reveal data that will be subjected to statistical analysis and interpretation for the purpose of extending the scope of inspection and testing.

CONTROL—In thinking of statistical quality control and applying its results, a supervisor or a machine operator should remember that the quality of manufactured products is always subject to some variation as a result of *chance*. This inevitable variation is directly the result of a stable system of chance causes inherent in any process. When only a stable system of chance causes is operating and there are no outside *assignable* causes of variation, a process is in *control* in its statistical meaning.

FREQUENCY DISTRIBUTION—A pattern of variation may be described by its frequency distribution, which shows the frequency of occurrence of variable values. Frequency distribution can be presented graphically by frequency histograms, bar charts and polygons.

If a smooth curve is drawn through the top points, its height at any point would be proportional to the frequency at that point and the area under it between any two limits proportional to the frequency within those limits. This curve is known as a frequency curve.

One certain frequency curve, especially useful in statistical quality control as distribution of average values tends to remain close to it, is the normal curve. An illustration of a frequency curve can be made by having 30 persons toss 10 pennies 100 times each and counting the number of coins which fall head up. Actually it is to be expected that there would be no-heads, one head, two heads, three heads, etc., and a few instances of ten heads. But some combinations would appear more frequently than other combinations.

Five heads, for example, would be expected to appear much more often than no-heads or ten heads. Fig. 1 shows that no-heads occurred 6 times and that ten heads occurred 3 times. Five heads appeared 731 times.

Continuous variations like these are subject to the law of probabilities, which in mathematics is sometimes referred to as the law of chance. The greater the number of pieces measured, the more perfect will be the form of the curve and the more accurate the predictions based on the actual findings.

For all practical purposes, 10,000 items are considered sufficient to form a relatively perfect distribution in the form of a normal curve illustrated in Fig. 2. This curve shows the percentage of area included under the curve between various standard reference points. More will be said later about these reference points, which are designated as ± 1, 2 and 3 sigmas (σ).

AVERAGE—According to the law of chance, there is a mode, or most frequently occurring value, from which the variants differ in that some will possess the characteristic being measured to a greater degree and some will possess the characteristic to a smaller degree, while the greater number will resemble the modal type. In Fig. 1 the mode is represented by the line that indicates five heads and five tails.

In a true normal curve involving 10,000 cases, 5,000 cases will be to the right of the average and 5,000 cases will be to the left of the average, so the mode will be the arithmetical mean, or *average*. Fig. 2 shows that, for a perfect normal curve involving 10,000 cases, 6,826 cases will be concentrated about the average and within the limits marked off by the reference points, -1 sigma and $+1$ sigma.

The average, denoted as $\bar{X}$ and read "X bar," is an important measure of central tendency and is used as a standard or reference point. For example, in 10,000 pieces machined to 1.000 in. ± 0.005, the true average size piece would be 1.000 in., the basic size.

A few pieces would measure 0.995 in. and a few pieces would measure 1.005 in., but the majority would be 0.999, 1.000 and 1.001 in. The greatest number of pieces would measure 1.000 in., or very close to it, if the measuring device includes ten-thousandths of an inch. This is the average, or the piece with the greatest frequency of occurrence.

STANDARD DEVIATION, or SIGMA—A careful analysis of Fig. 1 will show that in the middle of the curve where the greatest number of cases is concentrated, the curve is uniform. At the ends of the curve the variation is great and the curve irregular. The curve will be regular only for a perfect distribution.

As no actual distribution is perfect, the graph must show these imperfections or irregularities. There are twice as many cases in Fig. 1 that show no-heads as show ten heads. This is twice the normal expectancy for no-heads, as in 1,024 tosses of the 10 pennies only one case of no-heads can be expected. For the 3,000 cases, no-heads can be expected three times. As a matter of actual fact, there were six.

It is important therefore to establish measures on both sides of the average, or measure of central tendency, of any normal distribution of accumulated data or measured pieces. For convenience, the base line xy in Fig. 2 has been divided into sigma units. Three sigma units to the right of the average, or $+3\sigma$, and three sigma units to the left of the average, or -3σ, include almost all the 10,000 cases represented by the normal curve.

For all practical purposes, therefore, the number of sigma units specified as the deviation of a particular piece from the average is an exact and precise mathematical determination of the amount of deviation of that particular piece from the central tendency of the entire distribution.

Thus, for 10,000 pieces made to 1.000 in. $\pm$ 0.005, a piece measuring 0.995 in. would be -3σ below the average, and a piece measuring 1.005 in. would be within $+3\sigma$ of the average. Actually, the number of pieces in a run of 10,000 that would be included in the area under the curve set off by the standard deviations indicated by the points marked -1σ and $+1\sigma$ would be over 6,800.

The standard deviation then is merely an indication of the amount of deviation from the average of a distribution.

RANGE—Another measure of disper-

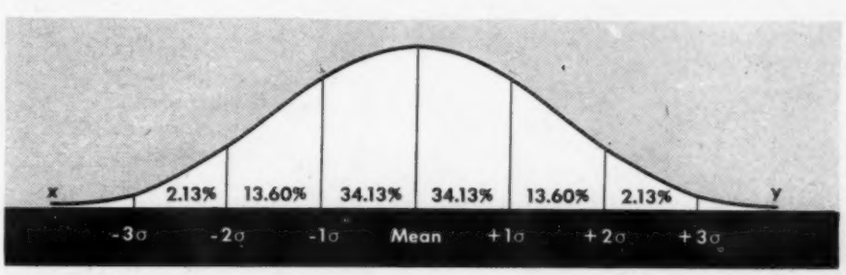


Fig. 2—A normal curve between $\pm 3\sigma$ includes 99.72% of the total distribution, between $\pm 2\sigma$ 95.46% and between $\pm 1\sigma$ 68.26%. The normal curve is one certain frequency curve, especially valuable in statistical work

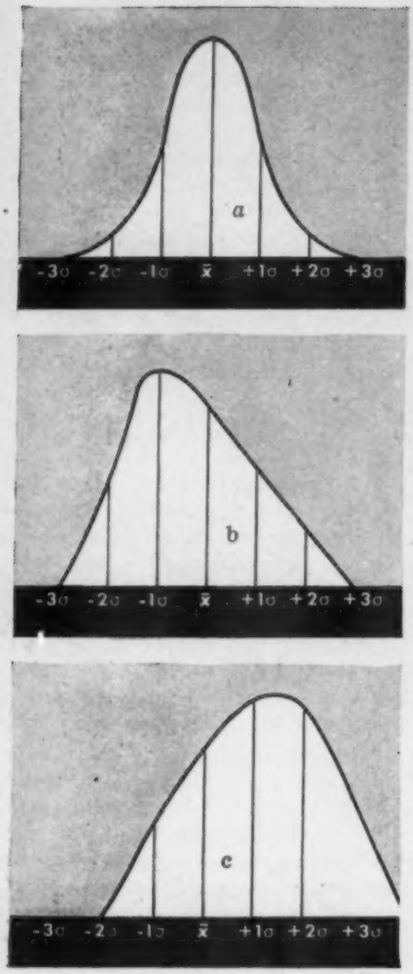


Fig. 3—In the normal curve *(a)*, half is above and half below the average. In a distribution skewed to the left *(b)*, more than half are below the average, while a skewed curve to the right *(c)*, shows majority above average. Curves *(b)* and *(c)* indicate need for control

sion, called the range, is more easily understood than standard deviation. In any variable lot, the range R is the difference between the largest and smallest observed values. Thus, for a sample lot of pieces measuring 1.50, 1.51, 1.47, 1.54 and 1.52 in., the range would be 0.07. For a group of sample lots, the average of the ranges, or $\overline{R}$, would be the sum of the ranges divided by the number of sample lots.

In statistical quality control, range rather than standard deviation should be used as a measure of dispersion. Range is easier to calculate, which is considered more advantageous in chart work than any theoretical advantage gained from use of standard deviation.

RELIABILITY — The reliability of any measure is an indication of how good the measure actually is. It is possible to calculate the reliability of the average. Such a calculation reveals actually how good or correct is the average found. The reliability of a measure usually indicates the limits within which the measure will be correct and accurate.

The reliability of a calculated standard deviation is measured by the probable divergence of this measure from the true standard deviation, that is, the standard deviation of universe, or parent distribution, from which a sample is taken. The true standard deviation could be secured only on the basis of an infinite number of measures, or on the basis of all possible measures of the characteristic in question.

Obviously, even a group of 10,000 items is only a small-lot sampling of an infinite number of cases. For all practical purposes, however, 10,000 cases will give a relatively perfect normal distribution curve if the pieces are representative unselected pieces and no unusual factor is operating to skew the distribution to the right or left.

To make this point clear, let us suppose that 8,972 American soldiers at one camp had an average height of 67.57 in. Let us suppose also that the standard deviation of this distribution was calculated to be 2.62 in. The question that naturally arises is, "How reliable is this standard deviation?" How well does it represent the true standard deviation obtained if the average height of all American soldiers were calculated and the standard deviation computed from this average height?

The point 1σ includes 34% of the cases on either side of the average. Therefore, $\pm 1\sigma$ would include 68% of the cases, or 6,101 soldiers of the total 8,972 soldiers. Thus, in 68 cases out of 100, it would be found that any random unselected soldier would have a measured height somewhere between the limits 67.57 in. $\pm$ 2.62, or somewhere between 64.95 and 70.19 in.

When the reliability of the standard deviation is calculated for these 8,972 soldiers and if the reliability of the standard deviation is 0.0199, then it is possible to say with almost 100% accuracy that the height of every 68 in 100 soldiers will lie between the limits of 67.57 in. $\pm$ 2.62 $\mp$ 0.0597. The latter figure, 0.0597, is three times the figure 0.0199 and is in reality a standard deviation of the standard deviation of the distribution. The value, $\pm 3\sigma$, will include almost exactly 100% of the cases.

Furthermore, because the standard deviations are on either side of the true average, the true average of the distribution lies somewhere between the limits arrived at by calculating 67.57 in. $\pm$ 2.62 $\pm$ 0.0597.

It should be borne in mind that any of the measures used in statistics can be subjected to the reliability formulas.

SKEWNESS — Very few distributions are normal or follow the pattern of a prefect normal curve. A distribution may be skewed to the right or to the left. For example, if the majority of the 10,000 pieces machined to 1.000 in. $\pm$ 0.005 were between 1.000 and 1.005 in., the distribution would be skewed to the right, or have right skewness. If the majority of the pieces were machined between 0.995 and 1.000 in., the distribution would be skewed to the left, or have left skewness. Skewed distributions are asymmetrical, whereas normal curve distributions are symmetrical, as shown in Fig. 3.

Purposes of Quality Control

Instead of inspecting pieces after they are completely machined, dimensional quality control inspects a representative sample of the lot produced at the machine where the part is produced. Statistical quality control aids in locating the cause of mistakes as they are being made.

The actual measurements found are recorded on a quality-control chart at the machine. By applying the simple mathematics of the laws of chance, data are obtained that help to keep the machined pieces within acceptable limits with concomitant reduction in loss of manhours, material and down time for machines. The charts tell when to make machine adjustments and when to keep "hands off."

Quality-control data help to determine desirable changes in production specifications. Sometimes a change in tolerances suggested by analysis of the quality-control data may improve a product.

Tolerances may be found to be too large and may be reduced if the quality-control data suggest that parts can be made to specifications even when tolerances are reduced. Or it may be advisable to increase tolerances in some instances.

Mass production makes accurate control of dimensions absolutely necessary, because interchangeability

of parts must also insure dimensional accuracy in completed assemblies. Some very excellent data on this point were presented in an article on "Tolerances on Assemblies" by Benjamin Epstein, in an article some months ago.

This is an important purpose, because in many industries component parts are produced in various parts of the country. Rigidity of adherence to specifications is the only guarantee that assembled units will be within the over-all tolerance of assemblies made up of component parts.

Quality control is also being applied to non-mechanical products in all fields of manufacturing and consumer goods, because that type of control saves time and material, and maintains dimensions or controls within prescribed limits.

The advent of quality control has changed the job of the inspection department. Heretofore it was simply necessary to inspect the final piece and pass it or reject it. In multiple operation work it was obviously useless to perform second and third operations on units that were oversize or undersize on the first machined dimension. This is the preventive aspect of statistical quality control.

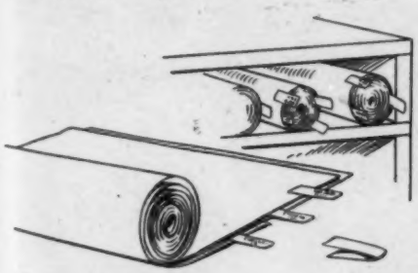
The diagnostic value of quality control is provided by an examination of the quality-control charts. Visual inspection shows whether the pieces being produced are satisfactory or whether they are approaching a limit that will call for tool or machine adjustment or a change in operating conditions.

Part II of this series on statistical quality control will be published in a forthcoming issue.

Short Cuts FOR THE SMALL SHOP

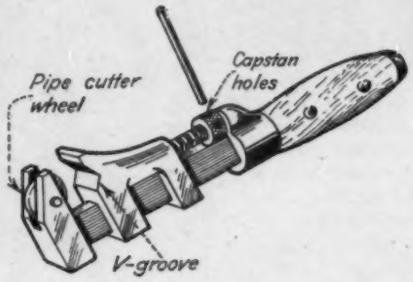
BY A. H. WAYCHOFF

EMERGENCY DRILLS for model work and similar purposes can be made from scraps of spring-steel wire. Cut off a piece about 3 in. long, heat one end and flatten. Then file a spear point on the flat, making cutting edges on the opposite side, and dress to the desired hole diameter. Then heat the drill and temper.

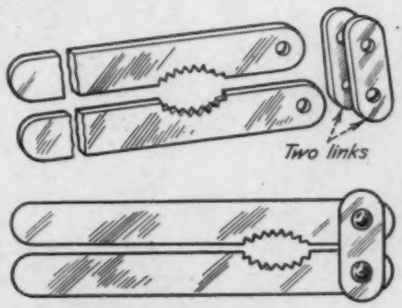


BLUEPRINTS that are rolled up and stacked in a bin are quickly identified if tab labels are applied to one end before rolling up. Adhesive-backed paper about 1½ in. wide makes good tab material. Tear off pieces about 4 in. long. Wet the ends of the pieces, fold and press onto the edge of the blueprint with about ½-in. overlap. Then the tabs can be labeled.

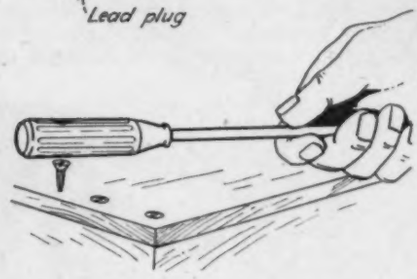
AN EFFICIENT pipe cutter can be made from an old monkey wrench. Cut a cross-wise V-groove in the face of the movable jaw to back up the pipe or tube. Saw a slot vertically in the stationary jaw to receive a common pipe-cutter wheel



and drill a cross hole for the retaining pin. Finally, drill holes in the periphery of the nut, so it can be used like a capstan to apply cutting pressure.

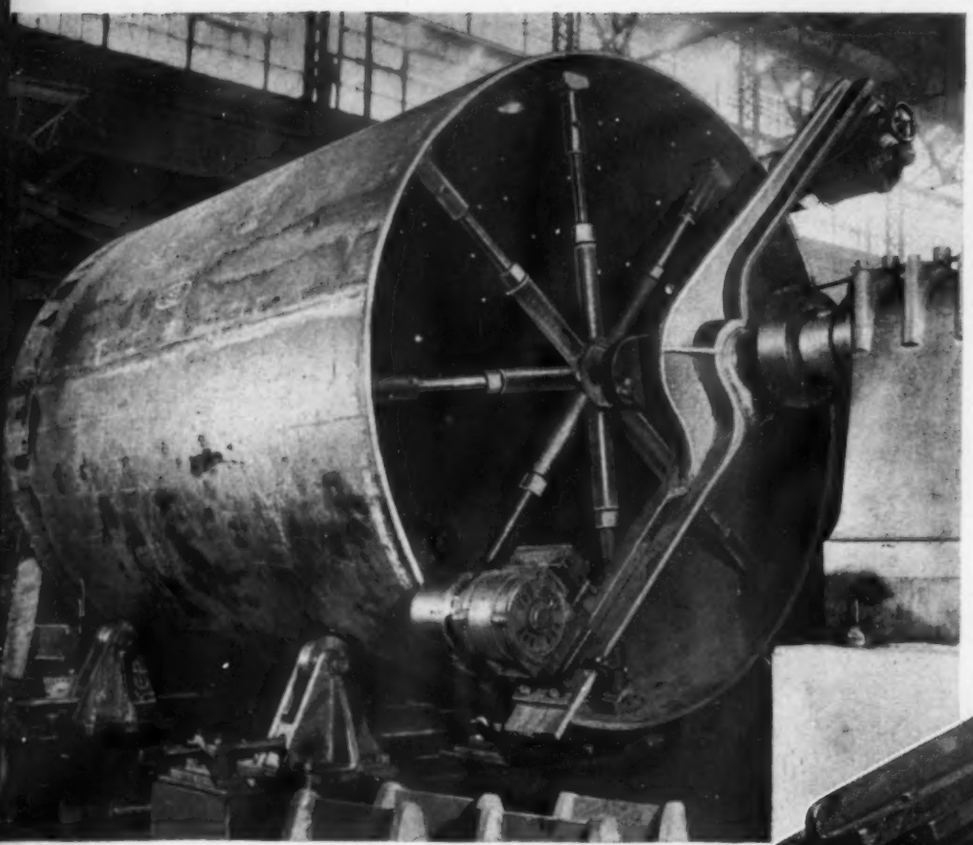


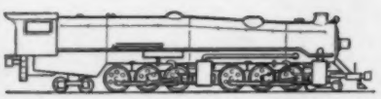
A THIN GRIPPER speeds removal of a tight nut from a freely turning machine screw, if there is room to apply the device to the free end of the thread. Make the gripper of two strips of 18-gage strip or thinner. Cut half-round openings about 3 in. from the ends of the strips, file teeth to produce semi-circular jaws. Drill the adjacent end of each strip, make two pin links of the same gage, assemble links on opposite sides of tool and rivet loosely. The jaw teeth can be shaped so they fit into the thread to avoid damage to it.



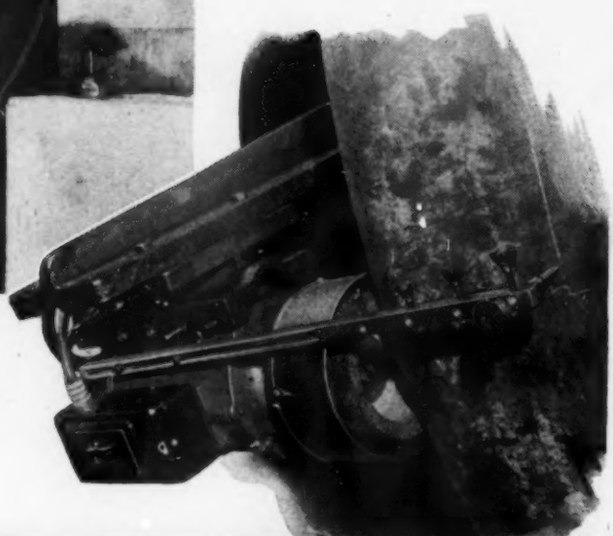
WOODSCREWS can be started and driven without using both a hammer and screwdriver. Merely drill a ¾-in. cross hole in the solid handle of the screwdriver (or to the blade shank), fill with lead and finish to the contour of handle. To use, hold the screw by the body and tap the head with the "lead hammer," then reverse the tool in the hand and drive the screw. When many screws are to be driven, this modified screwdriver will save a lot of laying down and picking up of tools.

Handling Is The Answer

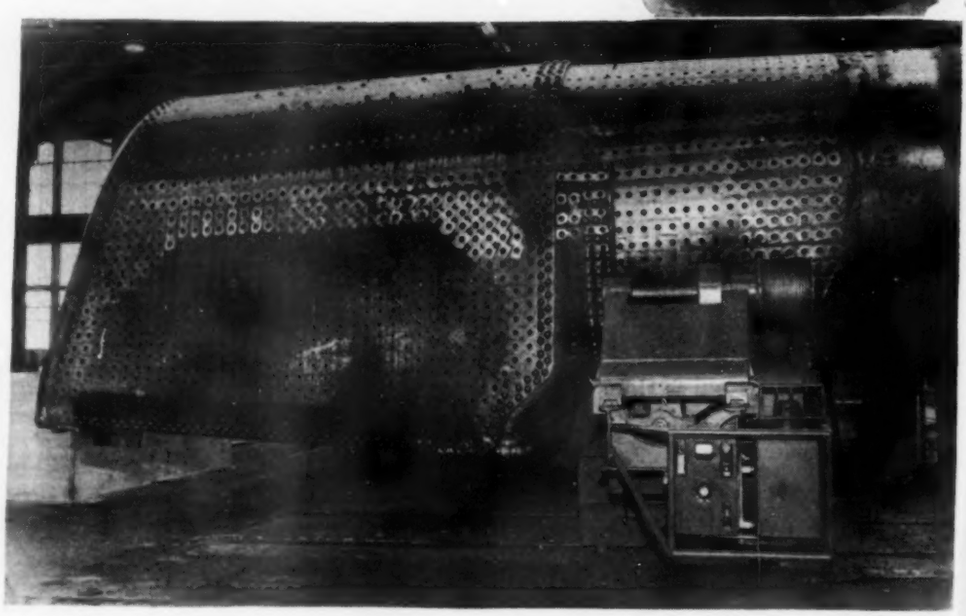




WELDED locomotive boilers, as produced by American Locomotive Company, Schenectady, are composed of sections, each rolled into a short cylinder and welded longitudinally. Each section must be trued up and squared off after welding to assure close fit with the next section



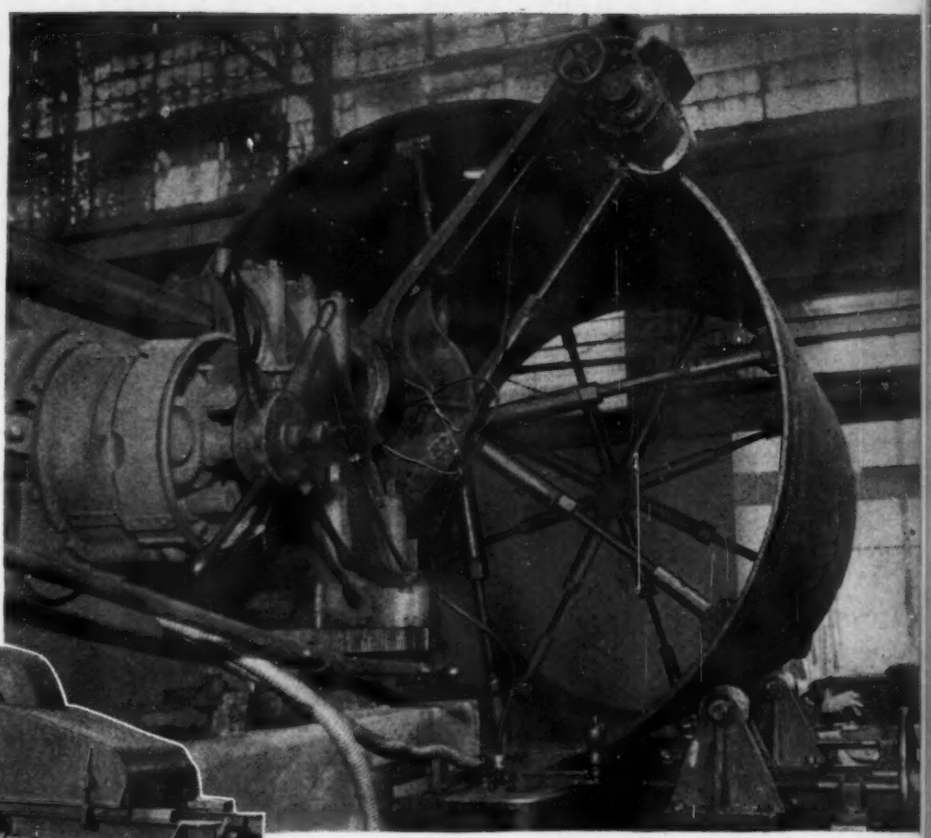
BOILER SECTIONS, after the longitudinal weld, are placed on two pairs of independently adjustable, concrete-supported special roller chocks, and heavy spiders are set in each end. The cylinder is rotated and the spiders and the four chocks are adjusted until an indicator shows concentricity and circularity within 0.015 in. Then a double-arm head carrying a small high-speed grinder unit at each end is rotated to square each end

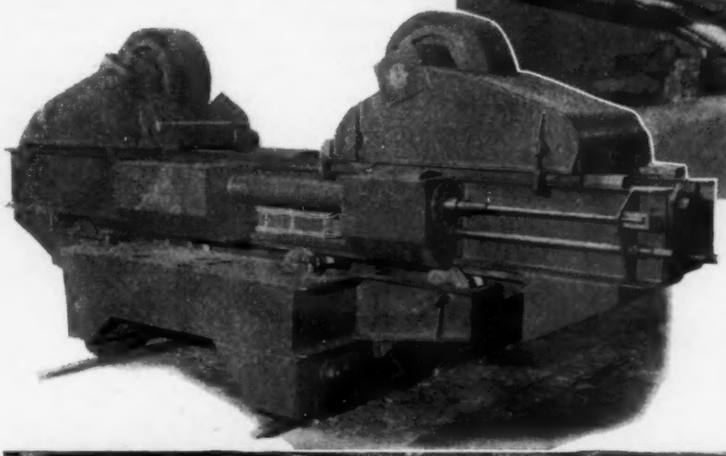


LOCOMOTIVE BOILERS are usually of such a peculiar shape that a fixed setting for the support rolls would not work. Automatic lateral compensation is necessary to keep uniform support and divide the load equally. In this case a riveted boiler is shown, for the positioner has been found equally useful on the more conventional boilers, too

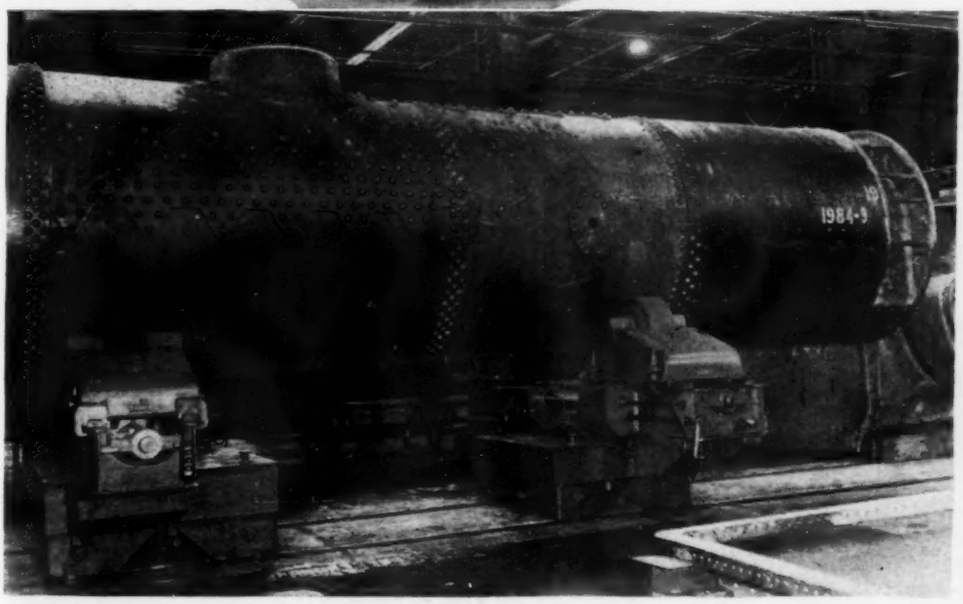
In Welding Loco Boilers

EACH GRINDER UNIT is adjusted along its own dovetail ways with a screw and handwheel until both cut the same, then feeding is accomplished by hand with the longitudinal spindle-feed spokes in the foreground. The controller, bottom center, is for the spindle motor. Simultaneously screwing two chocks at one end inward with the two appropriate independent handwheels raises that end of the boiler; moving one in and one out, shifts the axis horizontally





AFTER SECTIONS have been trued and squared, they are brought together on this triple carriage roller positioner, here seen from one end. The units rest on standard railroad track so they can be positioned longitudinally and small rollers on both sides of one rail take the place of flanges. The six rubber support rolls are laterally positioned automatically



AFTER FITTING and tacking and after the three carriages have been set, the whole boiler is slowly rolled over under power by the driving rolls (left unit) and when necessary the geared supplementary sheave with cables wrapped over the boiler for added grip, enabling the welder to make the circumferential seam from the best working position

BALL-PEN TUBULAR PARTS ROTARY-SLICED TO LENGTH

GOLD CAPS for CA ball-point pens are trimmed to within 0.010 in. of length on a bench lathe. A go and not go gage mounted alongside permits frequent checking. Rings of excess stock on the mandrel are stripped after each half-dozen cuts, to fall in a chute, thence through a tube to a tote pan. Mandrels are grooved (close-up) to prevent dulling the knife edge. Two grooves suit caps at opposite ends of the pen

Burrs and distortion are defeated by rotary knives that quickly cut gold, gold-filled and steel tubing for pen and pencil bodies and caps

BY JOHN W. DEAN, JR.
GENERAL WORKS MANAGER, EVERSHARP, INC.

MANY of the metal parts for Eversharp fountain pens and mechanical pencils are made from thin-wall gold, gold-filled and steel tubing. These parts must be cut off or trimmed without distortion of the thin-walled section, and without leaving burrs that would be difficult to remove. The metal tubes range from 7/32 to almost ½ in. in diameter. Most of the steel tubes used have a 0.0065-in. thick wall. The gold and gold-filled tubes have wall thicknesses ranging from 0.008 to 0.010 in.

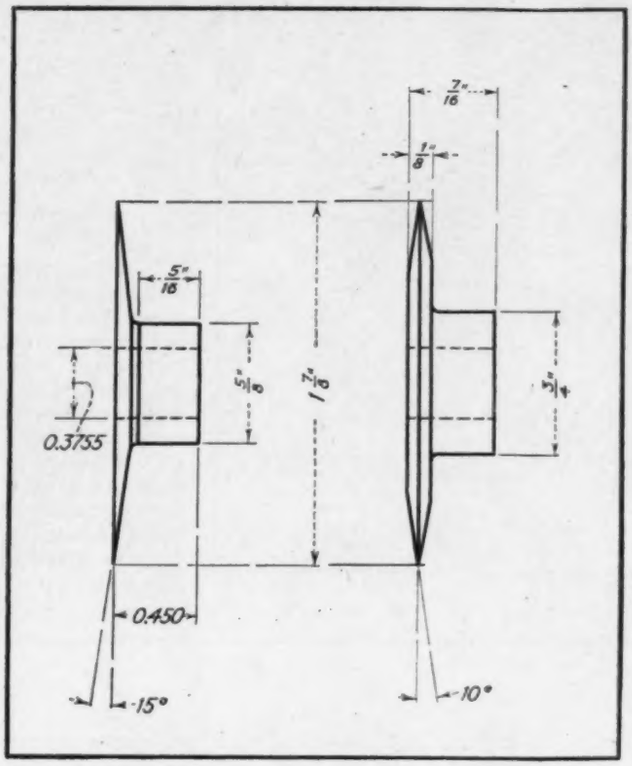
Experience has shown that these tubes can be cut off quickly and economically with razor-sharp hardened tool-steel rotary knives mounted on the cross-slides of small bench lathes. In each case, the lathe is driven with a belt-connected ¼-hp., 1,725-rpm. motor at a spindle speed of about 2,000 rpm.

Where short lengths are to be cut from mill lengths of tubing, the tube is passed through the lathe spindle and gripped in a standard collet chuck. In such cases, the length of tube extending out of the back end of the spindle is supported in a felt-lined wood guide box to prevent scratching and to reduce the tendency to whip. No mandrel is used. The rotary knife is mounted close to the face of the collet chuck, so the rotating tube will have as much support as possible while it is being cut off.

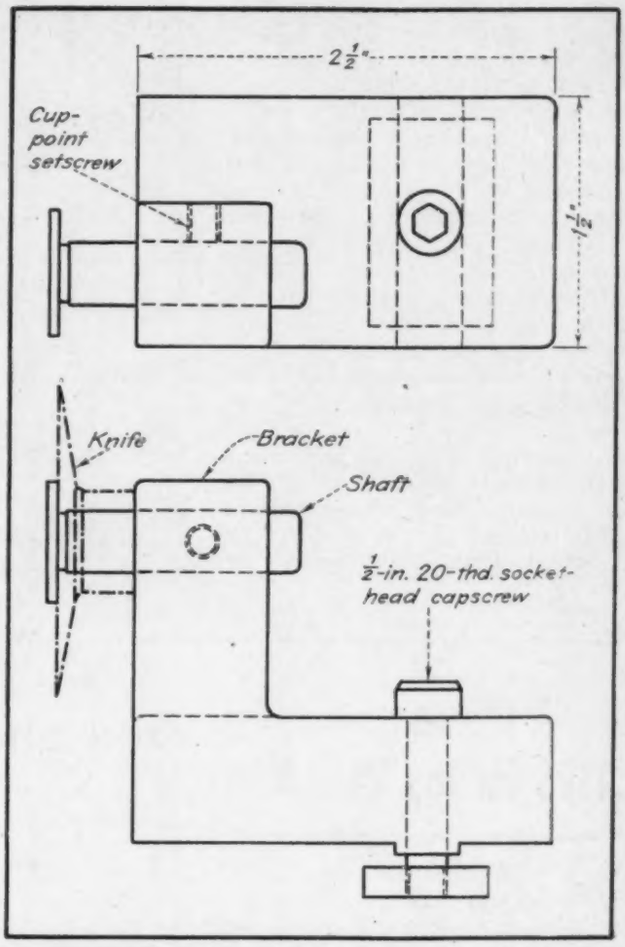
Usually, a stop is provided on the lathe cross-slide when short sections are to be cut. It is positioned in front of the tube when the cross-slide has been moved forward and is withdrawn as the rotary knife blade is advanced by hand feed of the cross-slide. Stop screws at each end of the cross-slide make it easy for the operator to locate the stop properly, and to determine when the knife has been fed to the proper depth into the tube wall.

Closed-end caps for fountain pens are trimmed to length on a mandrel. The length of the mandrel extending past the blade determines the length to which the cap is trimmed in such cases. Most of these cutoff and trimming operations are very rapid, production averaging approximately 800 pieces per hour.

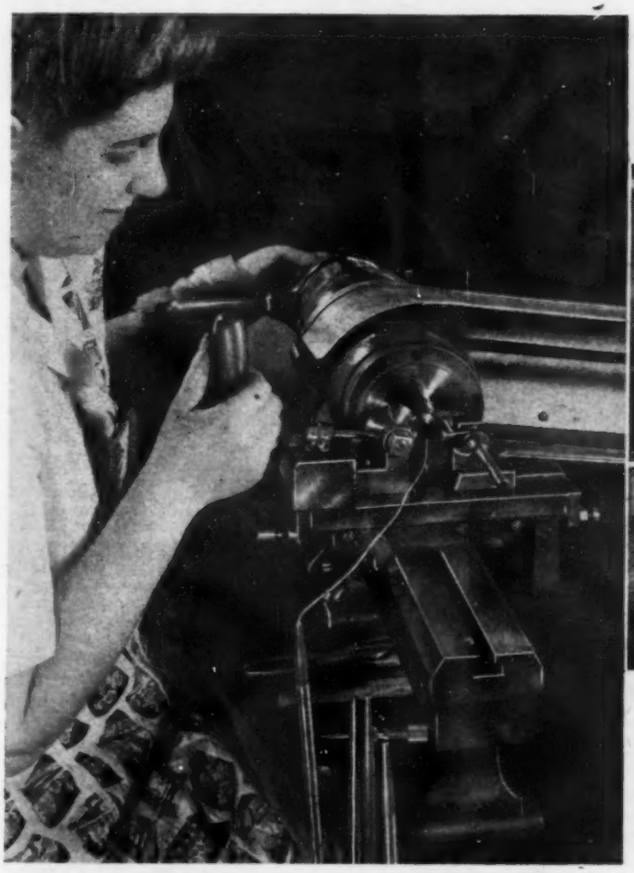
The same 1⅞-in. dia. rotary knife is used for cutting off all thin-walled

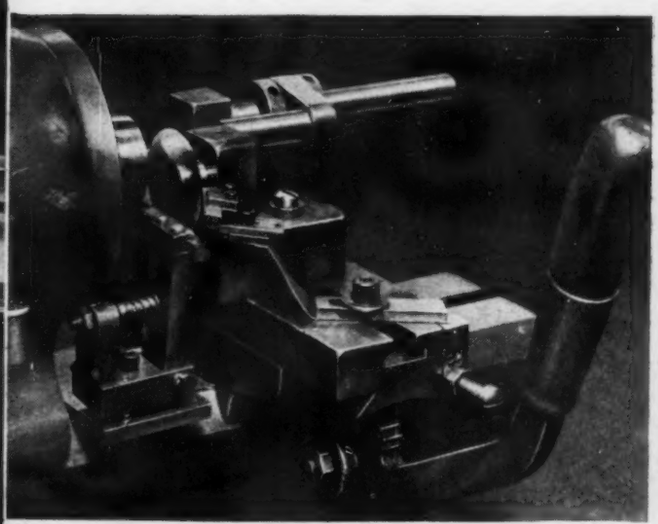


HARDENED AND GROUND H.S.S. rotary knives, with honed edges, are sharpened on one face for cutting metal, on both for plastic. Knife bore is 0.3755 in., lapped to plus 0.0003, minus 0.000, for an easy-running fit on the 0.375-in. shaft



CROSS-SLIDE BRACKETS for the knives are C.R.S., with a hardened and ground drillrod shaft set horizontally. Integral with the shaft is a ¾-in. dia. head which holds the blade in position longitudinally

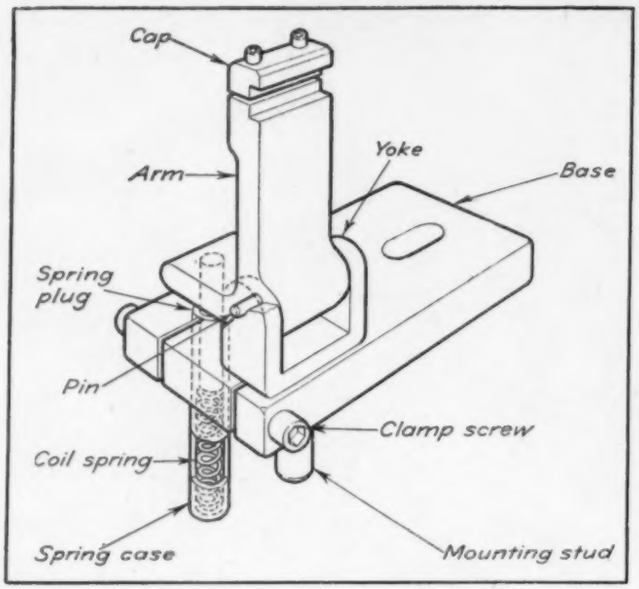




FRICTION RINGS for caps are cut from thin-walled gold tubes held in the lathe collet. 1200 rings per hr. slide down the wire to the tapered rod held vertically beside the bench. Contact with the tube revolves the knife, which is slowed (to increase cutting action) by an abrasive block in a spring-loaded holder (two types in close-up) which hones the blade

metal tubes, whether made of steel, gold or gold-filled alloys. These knives have one flat face, with the second face ground and honed to a 15° razor edge. All rotary knives have a 0.375-in. bore lapped to an easy running fit on the 0.375-in. dia. support shaft. These blades have an average life of about 100,000 cuts.

"Pyralin" plastic tubes, for pen and pencil barrels, also can be cut off with rotary knives. However, in these operations the 1⅞-in. dia. knives are ground and honed to provide a razor-sharp edge having a 20° included angle, 10° each side of center. The Pyralin tubes range from ⅜ to about 9/16 in. O.D. and have a wall thickness averaging about 0.060 in. Usually, these molded plastic tube sections can be trimmed to length at about 3,000 pieces per hr.



A C.R.S. holder for an abrasive stone has yoke, spring case (for loading the arm) and mounting stud adjustably clamped in the ⅜ x 1⅝ x 3-in. baseplate. Thus abrasive can readily be positioned against the blade

TIPS for Top Shop Men

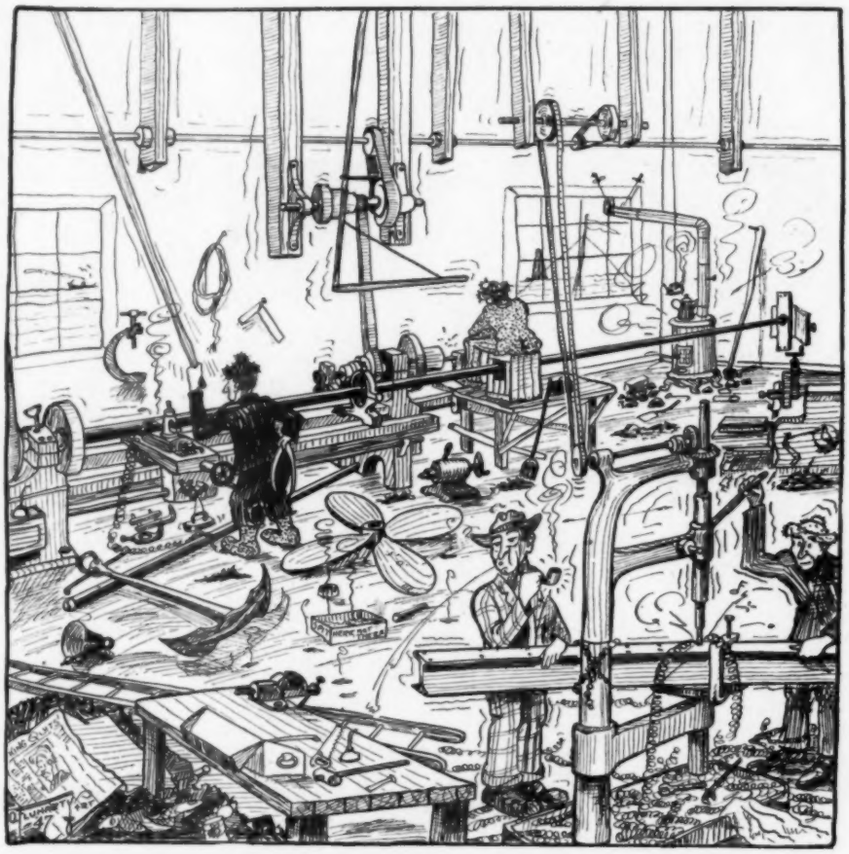
156 Be a leader, not a boss. Go out of your way every once in a while to do the jobs you're expecting others to do and grin about it. Go to the man you want to talk to, instead of calling him to you. And break down enough to explain why you're making a change when you do. A man can do better when he's let in on what's going on. Unless it's a policy secret—and then, how come you know all about it, brother?

157 Offer an occasional "Share-the-Management" plan. When work is slack, put men to improving methods, offering suitable awards. They'll add materials handling, simple jigs and fixtures, lighting and paint that you'd never think of. Costs will be peanuts, but savings plenty.

158 Servility has no place in democracy because it always must be accompanied by arrogance. The man who bows and scrapes to you expects his subordinates to do the same to him, just as a butler insists that maids show deference.

159 Somehow, somewhere, someone started the idea that the size of an organization is an index of the importance of its boss. As a result, departments, particularly overhead or non-productive ones where costs don't immediately show up, have a way of mushrooming like a government bureau. It may be helpful to remind such "executives" that they can get a good job where they'll be over thousands of men—as night watchmen in a cemetery.

OUR SHOP . . . 18 — *B C (Before Conversion)*



KEEP AIR CLEAN

BY C. H. MEHAFFEY, INDUSTRIAL DEPT.,
MINE SAFETY APPLIANCES COMPANY

Some processes produce harmful concentrations of dusts, mists, fumes and gases, or vapors. Here are permissible safe quantities and methods of control

INDUSTRIAL AIR contaminants are usually classified as dusts, mists, fumes and gases, and vapors. *Dusts* are solid particles of material carried by the air, originally formed by some mechanical action or process, such as grinding, polishing, buffing, etc. *Mists* are tiny liquid particles or droplets, usually dispersed into the air by such processes as spraying or by gas bubbles breaking through the surface of a liquid. Common examples are oil mists formed in paint spraying and acid mists over chromium-plating baths. *Fumes,* like dusts, are also tiny particles of solid material, but formed by chemical action or condensation. The white smoke rising from welding galvanized metals is a zinc fume. *Gases* and *vapors* have no definite form or shape; gases being those commonly found in a gaseous state at normal temperatures and pressures, while vapors are frequently found in liquid or solid states at normal temperatures and pressures, but are converted into the gaseous state by increased temperatures or decreased pressures. Carbon monoxide is a typical gas, the evaporant in the air over a tank of gasoline is referred to as a vapor.

Any foreign material in the air is a contaminant. Many air contaminants do not cause actual injuries to health, although most will cause discomfort if present in high concentrations or considerable amounts. Some materials irritate or aggravate the respiratory tract, some injure the lungs, others are rank poisons which can cause all sorts of bodily disorders.

Operations where harmful amounts of materials are likely to be present in the air usually occur in the processing or finishing of machined work. Examples of such processes include: degreasing, because the vapors of most degreasing solvents are injurious if breathed; spray painting, in which the paint thinner and the paint pigment can both be injurious; heat-treating, where harmful and irritating materials can be given off; polishing, buffing or grinding on metals or materials which are toxic; metal-spraying where some of the alloys used are harmful to breathe; and welding, cutting, brazing, babbitting and plating.

Industrial hygiene engineers and physicians have made numerous studies in recent years to determine the concentration of various materials which may injure health if inhaled over a period of time. The American Standards Association is continually establishing new standards of permissible concentrations of toxic materials. Such figures roughly represent the amount which the worker can continue to inhale in an 8-hr. day without harmful effects. There is nothing precise or absolute about these toxic limits. Many variable personal factors may make it possible for some workers to stand much greater amounts and apparently remain in good health. However, these toxic limits do serve as general guides to the relative safety of an atmosphere for breathing; where poisonous contaminants are present in the working atmosphere, an attempt should be made to keep their concentrations below these accepted standards.

The accompanying table indicates toxic materials which may be present around shop processes, together with the permissible concentrations as established by the A.S.A. or other accepted authorities. Concentrations of gases and vapors are usually indicated in parts per million (ppm.), the amount by volume in proportion to the air. Concentrations of dust, fumes and mists are usually indicated in milligrams per cu. meter of air ($mg.m.^3$); 10 cu. m. being the volume of air inhaled by the average person during 8 hr. Dusts which injure the lungs, such as silica, are indicated in the number of particles per cu. ft. of air.

Determination of the Hazard

If any poisonous or irritating material is suspected in the air of the workroom, air samples properly taken and evaluated will indicate whether sufficient amounts are present to affect the worker's health.

The amount and kind of many gases and vapors in air can be determined by collecting an air sample in a sample bottle or bubbling through a suitable liquid, then having a chemical laboratory analyze the sample. Direct-reading instruments are available for many toxic gases, including carbon monoxide, benzol, hydrogen sulphide and trichlorethylene. Instruments are also sold which will indicate the percent explosibility of combustible gases in the air; this reading can sometimes be used as a rough check on a possible breathing hazard.

Determining the amount of particulate matter (dusts, mists or metal fumes) in the air frequently presents more difficulties than determining the concentration of a gas or vapor. Reliable direct-reading instruments for dust and fume concentrations are yet to be developed. The degree of hazards of fibrosis-producing (those which injure the lungs) and nuisance dusts are usually specified in numbers and par-

Some workers can take toxic vapors; others can't

ticles per unit volume of air. Poisonous dusts and fumes are determined in terms of weight of the toxic material in the air.

Where the number of particles must be determined, it is first necessary to obtain a representative sample of the dust in a known volume of air, then count the particles in a fraction of this sample in order to determine the total number of particles present. As most dusts of hygienic significance are below 10 microns in size, a microscope with a magnification of 100 diameters is necessary in order to see and count particles.

The most common method employed in the United States for determining the dust concentration is the Impinger, in which a sample of the dust is collected in distilled water or alcohol and then transferred to a special dust-counting cell and counted under a microscope. The period of sampling is from 5 to 15 min., depending upon the probable concentration and the length of the dust-producing cycle. Instruments are also available which collect the dust sample on a wet or sticky slide which is then viewed through a microscope. As such devices collect a sample during the fraction of a second, they provide only a rough approximation of the dust concentration.

Toxic dusts and metal fumes can sometimes be collected by bubbling the sample of air and fumes through a suitable collective liquid. However, a more common and simple method is to collect the dry fumes by electrostatic precipitation. In either case, the sample must be chemically analyzed for quantities and types of toxic materials present.

Where size of plant and type of operation make a large number of air determinations and studies necessary, it may be desirable to employ an industrial hygienist and obtain proper equipment to make studies. When information on air contaminants is required infrequently on special occasions and processes, several organizations and laboratories have satisfactory equipment and personnel. Most large insurance companies carrying industrial-compensation insurance have facilities for air-hygiene studies, as do State health and labor departments and many State universities. The Industrial Hygiene Foundation, Pittsburgh, Pa., a foundation supported by industrial and mining companies for improving the health of industrial workers, has a well-trained staff of industrial-hygiene engineers for consultation and to make detailed studies of air conditions in plants or processes.

Control

If studies indicate that certain materials are present in concentrations harmful to health, immediate steps should be taken to reduce these air contaminants to a safe breathing level.

This can be accomplished by one or a combination of the following methods:

1. **Local Exhaust Ventilation:** Installing a suction hood over a grinding or buffing wheel, or lateral-slot exhaust ventilation near the top of degreasing tanks. Local exhaust ventilation is the most effective and satisfactory method. However, proper design and location of the exhaust hood as well as ample suction is essential.

Possible Air Contaminants and Maximum Safe Concentrations
(for prolonged breathing)

CONTAMINANT	PROCESS OR OPERATION	SAFE CONCENTRATION
Acetone	Spray painting	500 ppm.
Amyl acetate	Spray painting	200 ppm.
Benzol	Spray painting	100 ppm.
Cadmium	Welding, cutting, brazing, polishing, buffing, grinding, cadmium-plated metals	0.1 mg./m.^{3}
Carbon monoxide	Heat-treating and annealing	100 ppm.
Carbon tetrachloride	Degreasing	100 ppm.
Chromic acid	Metal plating	0.1 mg./m.
Fluorides	Welding stainless steel	2.5 mg./m.
Hydrochloric acid	Metal pickling	10 mg./m.^{3}
Hydrofluoric acid	Metal pickling	2 mg./m.^{3}
Hydrogen cyanide	Metal plating	20 ppm.
Lead	Welding, cutting or brazing, painted or lead-coated metals & spray-painting lead paints, metallizing.	0.15 mg./m.^{3}
Methyl alcohol	Spray painting	200 ppm.
Magnesium	Polishing, buffing, grinding magnesium or its alloys	15 mg./m.^{3}
Manganese	Polishing, buffing, grinding, welding or cutting manganese alloys.	6 mg./m.^{3}
Perchlorethylene	Degreasing	200 ppm.
Silica dioxide	Sand blasting	5000000 particles/cu. ft.
Sulphuric acid	Metal pickling	5 mg./m.
Toluene	Spray painting	200 ppm.
Trichlorethylene	Degreasing	200 ppm.
Turpentine	Spray painting	100 ppm.
Xylene	Spray painting	200 ppm.
Zinc oxide	Welding or cutting galvanized metals	15 mg./m.^{3}

2. **Substitution of a Less Toxic Material:** Often an easy method of making a process safer. For example, trichlorethylene is considered safe in concentrations below 200 ppm., while carbon tetrachloride has a maximum safe limit of 100 ppm. Therefore, the use of trichlorethylene in place of carbon tetrachloride in degreasing may reduce hazard by 50%. However, inferior or slower results may in many cases limit the possibility of substituting materials.

3. **Isolation or Enclosure of Operation or Process:** Will often reduce the number of workers who must breathe contaminated air by preventing the spread through the general working area of dusts, fumes, or gases. When harmful air contaminants cannot be controlled at the source, the process should be enclosed or isolated so only men on that particular operation are exposed.

4. **Wet Methods.** Water can be used successfully in such work as grinding to prevent generation of dusts. Sprinkling floors in dusty areas prevents dust from being repeatedly "kicked up" by moving trucks and equipment.

5. **General Ventilation.** Where shop air is badly contaminated and contamination cannot be satisfactorily reduced by preceding methods, large fans or blowers may be needed to dilute the bad air by bringing in fresh or clean air. Such systems, if effective, are usually costly when power requirements and heat losses are considered.

6. **Good Housekeeping:** An essential part of most control programs, particularly where dusts are involved. Excessive amounts of dust must not be permitted to accumulate on floors, machines, etc., where it can continually be stirred back into the air.

Protective Devices

When one or more control methods fail to reduce air contaminants to safe concentrations, personal respiratory protection such as respirators must be relied upon. There are also many jobs which are performed infrequently or at various locations so it is impractical to set up ventilating equipment to remove the fumes or dusts. Occasionally there are processes, such as sandblasting, where conditions are so severe that ventilation will not make the operation safe, and a mask or helmet supplied with clean air for breathing must be worn by the operator.

Some workers, unaccustomed to respiratory devices, will resist their use unless convinced their own sealth and safety are menaced

The U. S. Bureau of Mines under the Department of the Interior has set up procedures and equipment for testing personal respiratory protection devices on the basis of comfort and efficiency. A respirator or mask, after approval by this agency, is issued an approval certificate and approval number. A copy of the certificate and the conditions and limits under which the device is approved appears on every box and carton in which the product is sold, and the approval number appears on each essential part of the equipment.

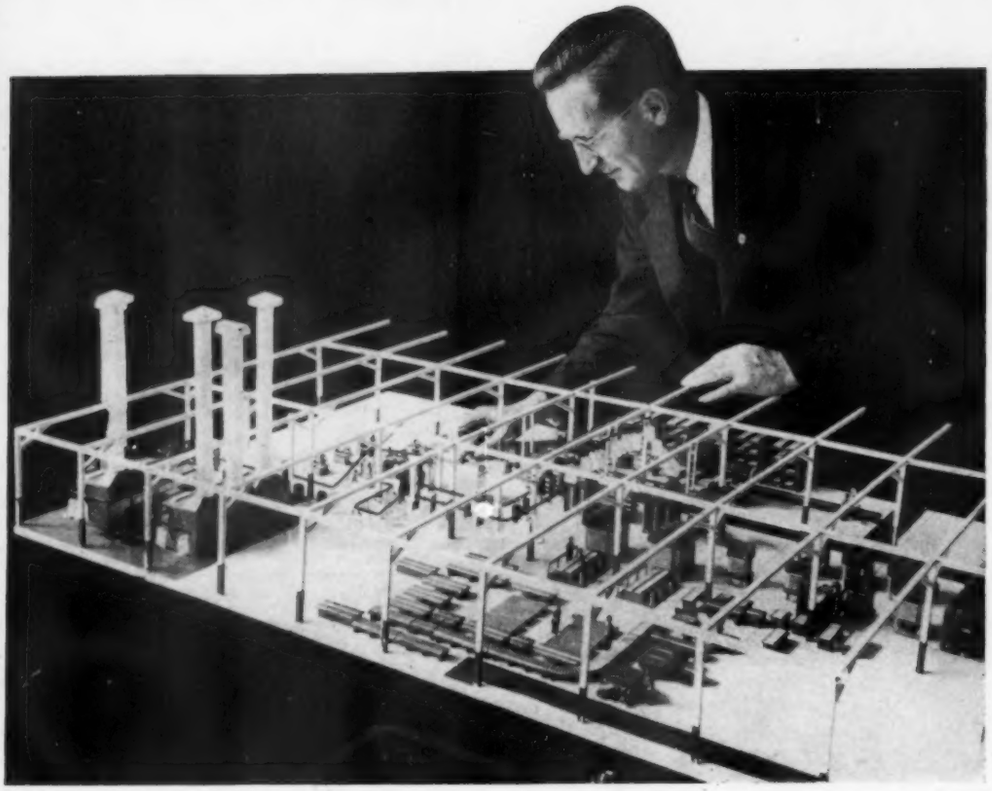
Today the U. S. Bureau of Mines Approval is a recognized standard of respirators and masks by industry, state agencies, insurance companies and other groups interested in occupational disease claims. As harmful dust and fume particles are so small they cannot even be seen in normal light, a very good filter is necessary to remove them from inhaled air. As a general rule, sponge, cotton or gauze filters are effective only against large particles, which would not penetrate the lungs anyway. As it is not possible to tell without special testing equipment and technique whether a filter-type respirator is efficient, reliance should be placed on the U. S. Bureau of Mines approval when respirators are selected.

A mechanical-filter respirator is required for particulate matter such as dusts, fumes and mists, while the chemical respirators are necessary to remove gases and vapors. Also, a different cartridge is required for use against organic vapors than acid gases. In a dust respirator, a more efficient filter is needed for the lead burner than for the worker exposed to silica dust, because lead-fume particles are smaller in size and more toxic. Certain respirators of the filter or chemical type provide combined protection against several classes of air contaminants, but usually at the expense of greater bulk or higher breathing resistance. An ideal respirator from the standpoint of safety and comfort is the air-supplied unit in which the wearer breathes air transferred through a hose from outside the contaminated area. Air-line respirators provide no resistance to breathing because the flow of air to the face-piece is continuous and under slight pressure. If proper precautions are taken to clean and cool the air, absolute safety is assured under all conditions. However, the air hose which must remain attached to the wearer limits and restricts his movements so that on many jobs and operations this type is impractical.

Some workmen are unaccustomed to wearing respiratory protection devices and will probably resist their use unless they are convinced that respirators are important to their health and comfort. If the exposure is serious enough to warrant use of respirators, it is management's responsibility to educate and instruct men in their use.

Another important point in successful use of respirator apparatus is regular cleaning and maintenance. A workman cannot be expected to wear a dirty respirator—furthermore, such equipment will not function efficiently unless all parts are clean and in good repair. It is also desirable that each worker have his own respirator identified with his check number or name. Where such equipment is used infrequently and the respirators are not worn by the same person, thorough cleaning and sterilizing are essential before reissue.

Where there are a number of respirators in use, it is advisable to have one person responsible for cleaning and repairing the respirators. Most safety equipment, such as goggles, safety clothing, etc., can be cared for and issued by the same person.



THE AUTHOR, L. J. BELL, plans his plant layouts with the aid of three-dimensional models that stimulate the interest of supervisors, create discussion on advantages and drawbacks of particular layouts and add to incorporation of ideas from those studying layouts

Low-Cost Models for Plant Layout

BY L. J. BELL, LAYOUT ENGINEER
MICARTA DIVISION, WESTINGHOUSE ELECTRIC CORPORATION

Three-dimensional models can be made for small shops by using carved wood model as a pattern and casting plaster duplicates

ALTHOUGH three-dimensional models have been accepted by many layout engineers as having advantages not found in conventional templates, small plants have generally regarded them as being too expensive and difficult to obtain. But they can be made at reasonable cost by anyone with some degree of mechanical aptitude and common sense.

Such models represent the ideal method of presenting a layout. The initial presentation is invariably only the first of several discussions if the interest of those involved can be aroused to a point where further ideas, criticisms and suggestions are forthcoming.

Scaled models promote this interest to a much greater extent than do flat templates or drawings, which are hard for the average individual to visualize. If a picture can be built up in the minds of the group leaders, foremen, motion analysts and tool supervisors so they know what they are getting, their interest will be held and everyone will be more likely to submit suggestions.

This discussion, created by the use of models in the layout presentation, is the initial step toward laying the corner stone of a workable layout and toward perpetuating the ideas of those involved. No layout is any better than the thoughts and ideas incorporated into it, and no layout engineer should consider himself the exponent of all there is to know about this work.

The layout engineer should create a layout to the best of his ability for the first presentation. But the ultimate picture is not necessarily wholly his, but the consensus of the group selected to pass on the layout. If the interest of all parties can be stimulated by a life-like picture that stirs their imagination, a more comprehensive and workable plant layout will be achieved.

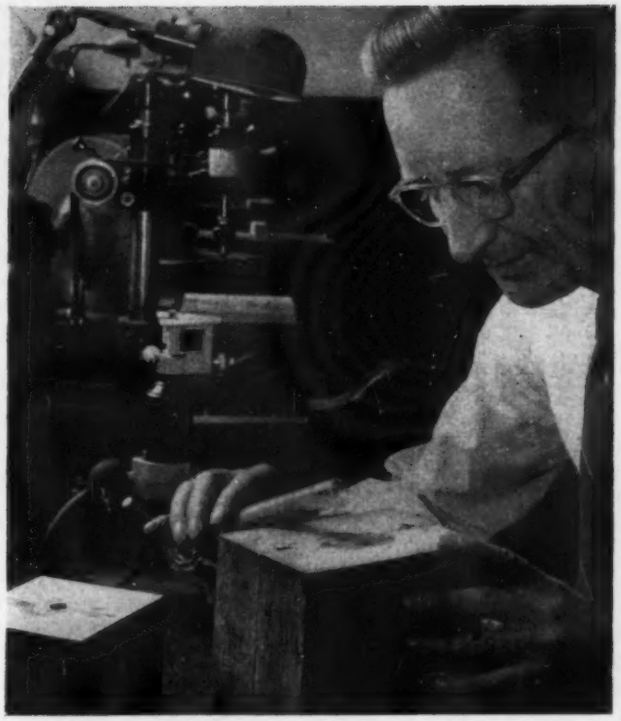
Many previous articles on models elaborate on the use of artists being employed for their manufacture. Although such work is without doubt above par and presents a pleasing picture when completed, any layout man can make a model that is fairly presentable and a hundred times more expressive than a flat template. After all, the length, width and height of the model are the main factors; any added details are for glorification. Of course, the more glorification, the more use the model will be as an aid for visualization.

Needed for Model Making

A setup for making models might include an 8- or 10-in. circular power saw, jig saw, drillpress, sander, power hand-cutting tool and miscellaneous chisels, files and other small tools. This equipment can be supplanted by expert manipulation of a penknife.

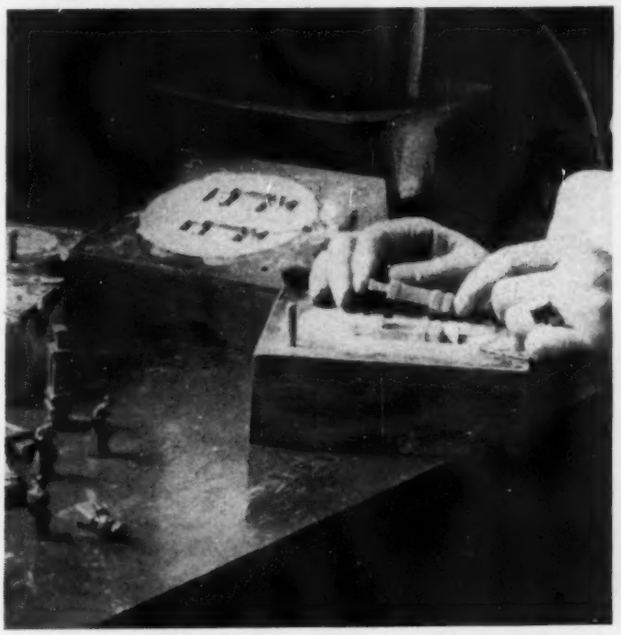
The first thing to consider is the scale, or size, to which the models

WHITE PINE is fairly easily worked by hand tools to contours representing machine tools, presses or other pieces of equipment. Sanding and shellacking prepares it for use as model or pattern



THE MOLD IMPRESSION is made in clay by the model pattern and the mold halves are clamped. The mold is then poured with plaster of paris or Quickstone mixed with water

POWER-OPERATED hand tools simplify model making, permitting grooves, radii and offsets to be worked into the wood and finished smoothly



CAST MODELS after setting are removed from molds, set aside to dry for 24 hr. and finished with shellac or liquid plaster, followed by bakelizing

are to be made. This should not be governed by any one individual layout, but by considering the total area of layout activity and the area in which the layout is to be made. Most analysis will show that ¼ in. to 1 ft. is best suited, and this figure is almost universally applied.

Straight-grain white pine wood is a good material from which to make the model or pattern. It is a little harder to work than balsa wood, but this extra work is more than compensated by added durability and life. After working the wood to the height, width and length required with a power saw, the model should be sanded immediately to give a good finish.

Then with chisel, knife and file, the necessary contours, offsets and grooves can be worked into the wood to produce a likeness of the machine tool, conveyor, truck, or bench that is being reproduced. The final sanding operation follows. In some cases, emery sticks will be satisfactory for this finish.

Heads and shanks of pins, thumbtacks and nails produce a further realistic appearance. A coat of quick-drying, clear shellac, followed by as many coats of paint as required to produce a good finish, completes the model. Most models are painted a slate gray, with aluminum representing finished or machined surfaces.

When more than one model of a

certain kind is required, reproduction may be made cheaply and quickly by molding, using the model as a pattern. Two pieces of hardwood or laminated plastic, approximately 3 or 4 in. square by 2½ in. thick with a hole 2½ in. in diameter by 2 in. deep bored in the center of each piece, make a good flask. These dimensions will vary, of course, depending on the size model to be reproduced.

The flash is completed by installing two stationary pins ¼ in. in diameter in diagonal opposite corners in one block, drilling two clearance holes in the other half of mold and drilling a ½-in. diameter hole in the parting line of the two halves to produce a pouring gate.

Casting in Molding Clay

Both halves can then be filled with Plasteline molding clay, packed solidly and struck off even at the top. Dusting both halves of the mold with talcum or any cheap powder to serve as a parting compound, and imbedding the model in the clay, as a foundry pattern is imbedded in sand, provides the mold impression. After the necessary vent holes and pouring gate are cut in clay and the mold is clamped together, it is ready for pouring.

Plaster of paris, mixed with water to a consistency suitable for pouring, is used to reproduce the model. If a vibrator is available, the mold can be poured with a slightly thicker solution that tends to set more quickly and is somewhat stronger. Quickstone, which can be bought at any dental supply house, is also satisfactory, running approximately 200 to 300% stronger than plaster of paris and having a quicker setting time.

This material costs about $0.12 per lb., while plaster of paris costs about $0.05 per lb. Ten or fifteen models, depending on their size, can be made from 1 lb. of material. Further research with materials of this nature may lead to some other that may be easier to handle.

From 10 to 40 min. are needed for the cure, depending on the material used. It is advisable to set the model aside after removing from the mold and allow it to dry thoroughly for 24 hr. before coating it with shellac, or liquid plastic if a bakelizing oven is available. A good model can be made with only the shellac coating and paint. To reproduce another model, it is necessary only to dust the mold, reimbed the wood model to reform the cavity and pour.

Some industries are making models with metal molds, and are producing metal models that are practically indestructible. For small plants, their cost is prohibitive at the present time when compared to the cost of a plaster model. But their cost may be reduced when the market for models creates a competitive field, or the tool and handling equipment manufacturers incorporate models in their advertising programs.

Until such time, only the central planning group of a large organization that has many hundreds of similar machines can afford the cost of casting models in metal. When the cost of a metal mold is distributed over several hundred models, the price per piece drops materially.

Construction of Floor Plans

The makeup of a floor plan can be accomplished in any one of several ways. Enough angle-iron tables, approximately 30 in. high and covered with ½-in. plywood screwed down securely, are made to represent completely all floor space that is involved. The tables, being portable, can easily be moved around for work on any one of them, or they can be bolted together to form a complete picture.

The plywood should be shellacked, allowed to dry and then painted with the desired color. White enamel is good. By using india ink and a ruling pen, all column lines and markings may be ruled on the surface.

Bases of the models can then be dipped in warm paraffin, and the models affixed to the floor by applying pressure gently for about 10 sec. This method of application will hold models firmly in place, but will not mar the finished surface of the floor plan. When it is necessary to rearrange them, they can be pried up and bits of remaining paraffin scraped from the board.

Columns and trusses of ¼-in. square maple wood, with saw cuts on two opposite sides to represent I-beams, are inserted into drilled holes in the plywood, and a horizontal truss is glued to the top of the columns with quick-drying model airplane cement. These are then shellacked and painted. Aisles are shown by using colored showcard paper. A removable roof can be added, formed from a transparent plastic which will increase the attractiveness of the installation and be of practical value for keeping the floor plan free of dirt and dust.

MODEL MAKING requires hand tools, circular saw, jig saw, drill press, sander, mechanical aptitude and some common sense. Any layout man can make models suitable for three-dimensional layouts and better than flat templates

INDUSTRY-WIDE BARGAINING...

Death Trap for Business, Suicide for Free Labor

IF CONGRESS is to succeed in its present efforts to prevent strikes in key industries from devastating the nation, it will have to put a crimp in industry-wide collective bargaining. This kind of bargaining is designed to apply agreements between employers and organized workers on wages and working conditions to an entire industry.

Further, if extension of this type of bargaining is not curbed, there is reason to believe that it will undermine the freedom of both American business enterprise and American wage earners. For, while increasing the destructive power of labor disputes, the general spread of industry-wide bargaining would so concentrate the fixing of wages—by far the largest element in the cost of production—that government regulation would be a next short step. With that step taken, freedom for business enterprise and freedom for labor would be well on the way out.

Unfortunately, industry-wide bargaining is commonly regarded as presenting a general conflict between organized labor and employers, with unions favoring it and employers opposed to it. This mistaken notion raises the heat of much of the discussion without increasing the light. The fact is there is no such general conflict. Employers and organized workers are on both sides of the argument about industry-wide collective bargaining. For example, while some union leaders are characterizing as labor baiters all those who raise the slightest question as to the desirability of industry-wide bargaining, organized workers in the air transport industry are strenuously opposing that type of bargaining; and the employers are advocating it.

Some Employers Like It

The reason there is in fact no clear cut issue between employers and unions over industry-wide bargaining is readily understandable. It presents certain advantages to both sides in the bargaining process. For example, union advocates of such bargaining generally stress the fact that industry-wide agreement on wages protects wage standards from being undercut by lower wage areas and lower wage employers. By much the same token, however, employers who like it often emphasize the fact that industry-wide bargaining may save certain well-managed and prosperous companies from being singled out for particularly heavy wage exactions. This general point has been underlined in both the full-fashioned hosiery industry and the West Coast paper and pulp industry. There, local unions, affiliated with international unions, have protested that industry-wide collective bargaining prevents them from getting from especially prosperous employers wages as high as they could get if allowed to go it alone in collective bargaining.

So long as employers remain subject to the federal antitrust laws while unions are exempted, the balance of power in industry-wide bargaining would seem to be heavily weighted on the side of the unions. If, for example, employers were to announce an intention to match an industry-wide wage increase by an industry-wide price increase, there is no doubt that they would promptly be indicted for violation of the federal antitrust laws. Even so, the fact remains that some employers favor industry-wide bargaining while some segments of organized labor are against it.

A Clear Cut Public Issue

The industry-wide bargaining issue as it affects the public, however, is clear cut. It is concentration of economic power (in the hands of both unions and management) which can make industrial conflict devastating to the public welfare. At least five times within about a year—in steel, on the railroads, in the maritime industry and twice in the soft coal industry—strikes prompted by union efforts to impose industry-wide agreement about wages and working conditions have paralyzed large parts of the nation's economic life.

In soft coal about 90% of the production workers are members of the United Mine Workers. In steel

about 80% of the production workers are members of the United Steelworkers, C. I. O. In some other key industries there is a comparable degree of concentration of union control. In the face of such concentration many employers see no alternative but to get together on their side for industry-wide bargaining. But when they do so in key industries, the odds are lengthened that failure to agree on wages and related matters, will result in generally ruinous conflict. If agreement is reached, the chances are increased that it will take too little account of the welfare of the consuming public.

It is possible to have industry-wide bargaining on many subjects other than wages. *But the main interest is wages; and the main drive is toward industry-wide and ultimately nation-wide uniformity. Such uniformity is the deadly enemy of industrial decentralization and the pioneering expansion of industry in new areas.* Why pioneer, with inexperienced workers, if the wage rate must be uniform for the whole industry? Moreover, it would also be hard to conceive of a more effective way to put a blight on local efforts to improve industrial relations than to make wage rates and other working conditions uniform throughout the industry and then the nation. *However, among many other dangers, the overshadowing danger in industry-wide bargaining lies in its concentration of economic power.*

Wages Monopolized

On the average, the cost of labor accounts for about two-thirds of the total cost of all industrial products. The universal spread of industry-wide bargaining would thus concentrate in relatively few hands control of the greater part of the cost of industrial production. There is no reason to believe that even without disastrous strikes, such concentration would long continue free from government regulation. That would turn more earth for the graves of American business enterprise and American working men's freedom.

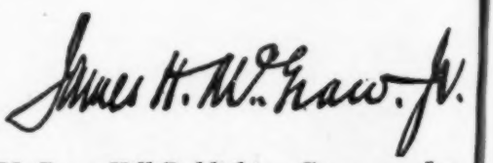
Those who believe that industry-wide bargaining serves the public well—and many sincere people do—stress the fact that, on the whole, it has worked in the industries where it has been tried over a considerable period. Most of the industries of which this is true, however, are not key industries. The pottery industry, the glassware industry, and the silk and rayon dyeing industry—to cite a few in which industry-wide bargaining has been practiced with considerable success—are important industries. But they are not industries in which strikes would have a ruinous impact on the nation. In contrast, a strike in the soft coal industry as the result of a breakdown of industry-wide negotiations quickly becomes a national disaster. The dangers inherent in industry-wide bargaining are multiplied accordingly.

England No Guide

Those who think extension of industry-wide bargaining would be good for the public often emphasize the fact that it has worked smoothly in England, where it has been extensively practiced. *Not the least of the things it has smoothed in England, however, is the transfer from private enterprise to state socialism of industries in which industry-wide bargaining by monopolistic unions and employer groups had so badly undercut competition that private enterprise had lost much of its justification.* A general extension of industry-wide bargaining could be expected to have the same consequences in this country.

The best way to curb industry-wide bargaining is a question which lies beyond this discussion. *Much would be accomplished if the federal government would discontinue its active promotion of industry-wide adjustments, in the fields of both labor and management, at which it has been busy ever since N. R. A. days. Still more would be accomplished if the federal antitrust laws were applied with even-handed justice both to unions and employers—a course urged in the 53rd editorial in this series.* Perhaps a definite limitation of the scope of labor agreements would also be necessary.

The effects of industry-wide bargaining in increasing the extent of public regulation of industry will vary. They will, of course, be less pronounced in railroads and other public utilities, which are already extensively regulated, than they will be elsewhere. For unregulated industries, however, industry-wide bargaining carries the threat of extensive regulation and, along the way, of industrial conflict devastating to the public. In these excited times, to say what I have said here is to invite characterization by overheated partizans as a foe of legitimate union progress. That is perhaps not so bad, however, as to qualify as a pall bearer for both American business enterprise and some of the basic freedoms of American working men. That may well be the fate of those who blindly accept the expansion of industry-wide collective bargaining as being "in tune with the times."



President McGraw-Hill Publishing Company, Inc.

Drawing Compounds

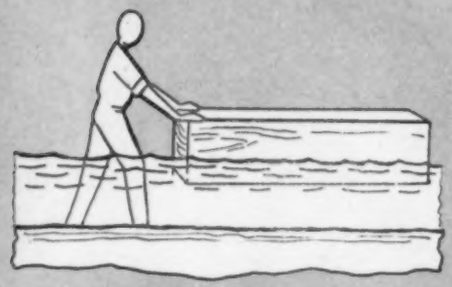
IMPROVE PRESS POTENTIALS

BY SAM SPRING
FRANKFORD ARSENAL

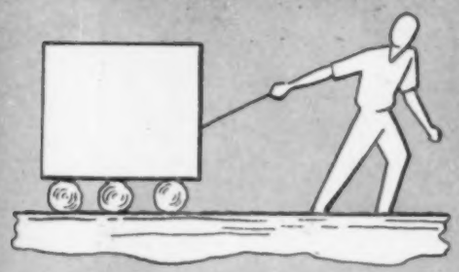
Progress in die design and finish, press design, annealing practices and improvement in the metals themselves may be set back if proper drawing lubricants are not applied. Deep-drawing practice has improved over the past few years and authorities on the subject say that this improvement can be attributed to lubrication more than any other one factor. The author delves deep into the subject to explore what happens when sliding metal surfaces contact under high pressures. Friction, welding, composition and application of modern drawing lubricants, chemical and physical tests suitable for production shops and recommendations for specific metals are covered in these pages

A SPECIAL American Machinist REPORT TO THE METALWORKING INDUSTRIES

FLUID LUBRICATION



BOUNDARY LUBRICATION



DRY FRICTION

Fluid lubrication, or thick film, is not possible in drawing practice because the lubricant cannot be maintained on metal surfaces. Boundary lubrication, or thin film, must prevent the dry friction that results in welding when two surfaces are in sliding contact

WELD PREVENTIVE

Any one of a number of compounds or materials may be used to keep metal surfaces under pressure from welding into a single matte. Sometimes it is necessary to apply inorganic fillers to keep surfaces sufficiently apart

LUBRICATION FOR pressworking metals involves more rigid requirements than for bearings and motors. In bearings it is possible to obtain fluid or thick-film lubrication, which is an almost perfect state of protection. Adequate protection for metal surfaces in drawing can only be obtained by boundary and extreme-pressure lubrication.

Fluid lubrication exists when the film is so thick that the laws applying to fluid in bulk are followed and resistance to movement depends only upon lubricant viscosity, unit pressures and relative velocities of parts. Coefficient of friction is low, wear of parts under normal, and mechanical design of the bearings is vital.

Where unit pressures are high, as in the drawing of metals, fluid lubrication cannot exist, and it is necessary to depend upon thin films of lubricant, which must remain in position because of their own characteristics. Coefficient of friction is high and effect of surface conditions is pronounced.

Because of surface irregularities, sliding metal surfaces actually make contact at few points. With moderately loaded surfaces, the area of contact is as small as 1/170,000th of the apparent area. When heavily loaded the peaks or hillocks tend to be deformed and area of contact may be 1/30th of the apparent area.

Surface irregularities can be reduced by removal of the metal which protrudes above the horizontal, as by grinding and polishing, or the metal can be smeared across the surface to cover the depression, as by burnishing. This gives a highly reflective surface which, after repeated sliding contact, flakes off and exposes the rough surfaces underneath. Softer metals drawn are then forced into rough crevices of the harder die metal, making lubrication more difficult.

Tool Finish Important

Surface finish of tools used in drawing metals is extremely important. In drawing steel tubes with hard steel dies, changing the polishing technique from the use of successively finer abrasive papers to one involving a lead lap in which very fine emery in oil is impregnated in a lead form, resulted in 400% longer die life. Rough tools should not be burnished, but ground, honed or lapped ones may be.

While tools should have a polished surface, a lightly etched matte surface on the work holds the lubricant in position more tenaciously. One of the best surfaces for drawing is that obtained on steel or brass after a furnace treatment and pickling. If an annealing is involved, a pickling operation provides a roughening action and increases adherence of the lubricant.

Friction, the resistance to motion of pieces in sliding contact, is considered by some to be a result of the interlocking of the hills and valleys on metal surfaces. This may be true for rough surfaces, but metal surfaces under load and separated by only 1/10th micron without lubricant, will weld to form a single matte at the point of contact. If the forces on the surface are great enough, the welds are broken immediately after they are formed. Because this welding takes place over such a small area and so rapidly there is no tearing of the surface visible to the naked eye. However, magnification shows that relatively large "bunks" of material have been torn from the surface to be deposited on any harder surface present.

Metals Influence Friction

Characteristics of the metals themselves strongly influence welding action. The greater the similarity between metal surfaces in contact, the greater will be the tendency toward friction and welding. Wherever possible the composition of the metal and the tool material should be as different as possible. In very severe drawing operations on steel, a thin layer of tin, copper or lead has been effective. Hardness of the respective metals should also vary considerably for minimum welding action.

The weld formed at one minute localized area is as strong as any other portion of the metal and the tear does not necessarily occur at the spot where welding took place. Thus a small amount of metal from one surface is deposited upon the other surface. When friction occurs under lubrication, the amount of metal deposited in this way is small and not visible to the eye.

If a soft metal rubs against a hard metal, a minute quantity of the softer metal will be deposited at some small portion of the harder surface because of a lack of lubrication at this point. When the surfaces make repeated contacts, there is a weak spot on the harder tool metal because on the second pass a soft metal comes in contact with a minute region of the same metal deposited on the hard tool. Under these conditions, even with good

lubrication the tendency to weld is increased. With repeated surface contact, the metal deposited on this spot increases until it can be seen with the naked eye. This is called "pickup", in shop terminology.

This metal has been work-hardened in tearing and is usually harder than the metal being worked. It will scratch or score the drawn piece and, the process being accumulative, buildup becomes greater and the scratches wider and deeper.

Function of Lubrication

The function of lubrication in drawing is to provide some material between metal surfaces which will prevent them from coming close enough together to weld. Where the force pressing the metals together is high, it is difficult to keep a lubricant in position because of the high shearing forces. Certain types of lubricant will, however, maintain themselves even under such high shear.

The major component of friction is a result of sliding between metal surfaces, but force is also required to overcome resistance to movement of the lubricant itself. For example, where a film of oil is present between two surfaces, some force is required to move part of the oil in relation to other parts of the oil. This churns up the oil during movement between the two surfaces. This force is small in comparison with the force required to break the welds formed as a result of insufficient lubrication.

Polar Lubrication

Under severe operating conditions it is necessary to rely on polar lubrication and on extreme-pressure lubrication. Polar lubricants are made up of molecules consisting of two parts, one charged negatively at the end of a long chain and the other charged positively, much like the positive and negative ends of a small magnet.

Polar lubricants are effective under severe conditions because the molecules are attracted to the metal surface and then maintained in position by means of these electrical chargers. The first layer of molecules actually reacts chemically with the metal and is attached to the metal surface so strongly that high shearing stress is required to displace it. These molecules, when attached to the surface, do so in such a way that the long neutral chain stands out perpendicular to the surface. This is desirable because the surfaces cannot get any closer than the ends of these neutral chains.

When the length of the chain is made adequate by use of proper chemicals and the surfaces are fairly smooth, this single layer which clings to the metal surface is enough to prevent complete welding action. For severe operation, these should be between 12 and 14 links in the chain, which actually consists of carbon atoms.

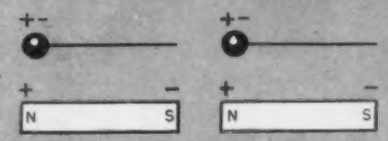
If surface irregularities are almost as long as the lubricant chain it is not possible to keep the surfaces apart by having only one molecule of these chemicals on the surface. Fortunately, this type of polar lubricant has the property of lining itself up into layers which are more than one molecule thick. It is possible to build up enough layers of these polar molecules so the surfaces are separated sufficiently for almost perfect lubrication but in most cases only the first layer (plus a few others) can be relied upon in the short operation cycle.

The layers of lubricant which pile on top of the first layer are not held to the metal surface quite as strongly as the first layer, and under the most severe conditions all but the first layer will be removed. Under average operating conditions it is probable that layers of polar lubricants in the order of 10 to 20 molecules can maintain themselves in position and provide fairly adequate lubrication. These films are so thin that they seldom prevent welding but they do keep it to a reasonable minimum. Polar lubricants suffer from the fact that their alignment and attachment to metal surfaces is sharply reduced in the temperature range of 200 to 300 F.

Extreme-Pressure Lubrication

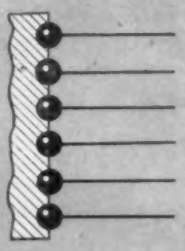
Metal drawing, under high-temperature, high-pressure conditions, requires extreme-pressure lubrication, which occurs because of the formation of compound or salt between the metal surface and some portion of the lubricant. The scale, composed of iron oxide, which forms on steel after heating is an example of this type of compound. An oxide of this type would not be decomposed at high temperatures, and it is for this reason that compound formation permits extreme-pressure lubrication. The compounds which are formed on metal surfaces which are effective

POLAR LUBRICANTS



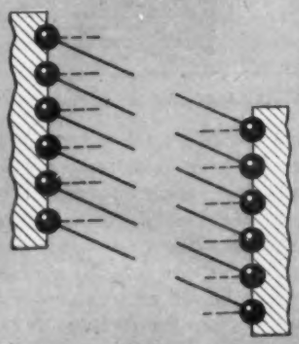
Severe drawing operations can be facilitated by polar lubricants, whose negatively and positively charged ends are similar in action to a small magnet with negative and positive ends. Molecules are attracted to the surface of the metal and maintained there by electrical charges

ADSORPTION



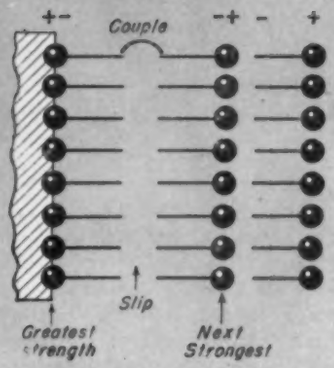
The first layer of molecules is held tenaciously to the metal surfaces, this adherence decreasing gradually as new layers come into place between the surfaces. The long neutral chains stand out perpendicularly from the surface, and the metal surface cannot get closer than the end of the chain

LUBRICANT MOTION



When two surfaces move past one another, as in a drawing operation, the layers of molecules slide on the end of chains. This tends to bend the chains away from the perpendicular, bringing the surfaces together but giving them a good slip plane in which to move

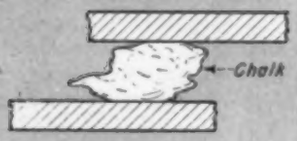
ORIENTATION



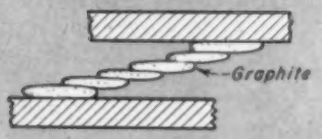
Polar lubricants have the capacity to provide more than one layer of molecules, providing good extreme-pressure characteristics for severe drawing. These layers decrease in strength as they are removed from the chemically and electrically desirable metal surface. The neutral chains couple in sliding past one another and breaking of the couple to provide slip constitutes the inherent friction in all lubricants in action

FILLERS

NON-CLEAVAGE



WEAK CLEAVAGE



Inorganic fillers fill somewhat the same function as extreme-pressure lubricants, separating metal surfaces under high pressure and heat. Non-cleavage type fillers are harder to deform, separate surfaces better and require more force to keep the surfaces in relative motion. This filler must actually be pulverized before motion takes place. Weak-cleavage fillers have both a separating and a friction-reducing action and require less energizing. Where welding tendencies are high and conditions severe, the non-cleavage type of filler is desirable

in extreme-pressure lubrication are much thinner that the scale formed when steel is heated. In fact, the thinner the compound is the more tightly it will be held on the metal surface and the less likely it is to crack during deformation of the metal.

Sulphurized oils, particularly sulphurized fatty oils, are the most commonly used components of drawing lubricants which supply extreme-pressure lubrication. They react with the surfaces after they become heated to form very thin films of sulphides or mixed sulphides and oxides. Other extreme-pressure lubricants which are applied contain chlorine and phosphorous which react with the metal surfaces to form chlorides and phosphides.

The thin film of oxide formed on fresh-cut metal surfaces on exposure to air is an extreme-pressure lubricant applied accidentally in most cases. These films can be thickened by heating in air or by long storage.

This is not true in the case of iron or steel exposed to damp atmosphere, because the red oxide formed under these conditions is not adherent and oxidation continues. In the case of copper and brass, the oxide layer which forms gradually becomes thicker on exposure. The oxide coating on aluminum is so adherent that further oxidation takes place slowly at room temperature.

Oxides As Lubricants

Use of oxides as the lubricant in deep drawing is widespread, and it is quite common in many shops to maintain a certain minimum length of time between pickling and the next redrawing operation. This schedule is based on experience, because the production man has learned that he runs into difficulties if he attempts to draw before this length of time. Sometimes this storage period can be eliminated by introducing to the lubricant a component which reacts with the metal surface just before and during the draw to form an extreme-pressure lubricant equivalent to the oxide. Greater control over the type and thickness of the coating by this method also eliminates many lubrication difficulties.

At Frankford Arsenal, storage of brass parts prior to redrawing was eliminated by giving the part a wash in an alkaline meduim after the pickling operation. This puts an oxide coating on the parts much more quickly than by storage in air, but is not effective with steel or aluminum.

Although not considered in the class of extreme-pressure lubricants, inorganic fillers often have the same effect. Such fillers are not affected by heat and grow in size between the metal surfaces, preventing them from coming into such close contact that welding occurs.

Inorganic fillers are divided into two general classes, those with weak cleavage planes and those of the non-cleavage type. In the first class are graphite, talc and mica; in the second class are chalk, lithopone and white lead. Because the low-strength cleavage planes cause fillers of the first class to slide readily over one another, the friction resulting from deformation of the filler is small and they have both a separating and friction reduction action because little force is needed to cause slippage. The non-cleavage-plane type of filler is a more efficient separator of surface, even though larger forces are required to cause relative motion between two surfaces. The most important frictional force to reduce is that required to break the welds, so even with the higher friction the non-cleavage filler is effective.

Low-Melting Solid Lubricants

Low-melting, semi-plastic solids, such as dried films of soap and films of wax, either from powdered solvents or emulsion vehicles, have become increasingly important in metal-drawing lubrication in recent years. Under proper conditions, a sheet of lubricant remains on the drawpiece even after it comes out of the die and under severe ironing conditions. This is true even of materials which because of lack of chemical reactivity are not capable of forming a bond with the surface to provide anchorage.

Wear On Tools

Wear on drawing tools comes from removal of built-up metal on the tools and the smooth and gradual removal of metal by the drawing process. If it occurs too frequently, the first type of wear is expensive because of removal of considerable metal from the tool. Where this removal occurs too rapidly, the best solution is to revise lubrication practice to prevent buildup by adding suitable components.

If buildup is slow or infrequent, lubricants prevent removal of more than a very small amount of metal. Occasionally this wear results from

COMPARATIVE TYPES OF FRICTION

SURFACE CONDITION	TYPE OF FRICTION	COEFFICIENT OF FRICTION	
		RANGE	AVERAGE
Unlubricated*	Dry	0.10 to 0.40	0.16
Boundary lubricated	Boundary	0.01 to 0	0.03
Perfectly lubricated	Fluid	0.0001 to 0.01	0.0006
Ball bearings	Rolling	0.001 to 0.003	0.002
Roller bearings	Rolling	0.002 to 0.007	0.005

*Surfaces covered with oxide and possibly water vapor. Bowden and Hughes reported that values are increased approximately 2.0 when surfaces are "outgassed" to remove oxide and friction is determined in a vacuum.

COEFFICIENT OF FRICTION FOR VARIOUS MATERIALS

COMBINATION OF MATERIALS	COEFFICIENT OF FRICTION
Tin — mild steel	0.18
Carbon — glass	0.18
Lead — mild steel	0.33
Copper — mild steel	0.36
Garnet — mild steel	0.38
Glass — glass	0.40
Hard steel — hard steel	0.42
Cadmium — mild steel	0.46
Mild Steel — mild steel	0.57
Copper — copper	0.60
Nickel — mild steel	0.66
Cadmium — cadmium	0.80
Aluminum — mild steel	0.74-1.0
Aluminum — aluminum	1.40

lubricants which are too effective While components in the lubricant which react with the metal surface to form compounds may effectively prevent welding, they may flake off under friction. This rate of wear is much smaller than removal of pickup on tools but should be minimized by reducing the reactivity of the lubricant.

Required Drawing-Compound Properties

WELD PREVENTION. A good drawing compound should prevent welding between metal surfaces, a condition possible only in the mildest of drawing operations. Depending upon the severity of the operation, it is sometimes possible to use one weld preventive in the lubricant, or it may be necessary to use a combination of preventives or even a combination of methods.

Sulphurized additives and fillers may both be incorporated in the same emulsion lubricant, where either alone might be ineffective. It may also be necessary to prepare the surface by applying a coat of copper or phosphate. Increased improvement is usually obtainable as the number of weld-preventive methods is increased and a limit is reached by practical considerations such as ease of application, unit costs and occurrence of mechanical failures.

REDUCING FRICTION. The major portion of frictional resistance may be reduced by weld-preventives, but it is frequently possible to select the lubricant on the basis of low resistance to motion within the lubricant in addition to weld-prevention. Sometimes a polar lubricant can decrease welding and frictional resistance of lubricant itself.

Force required to cause motion within a phosphate or sulphite coating is high. An additional lubricant which can be absorbed, or function in addition to the weld preventive so the motion between the parts takes place in this layer of polar lubrication and not in the phosphate or sulphite coating, lowers this required force.

This allows greater ease of drawing, permits a more even flow of metal and prevents puckering of cheap metal during drawing.

EASE OF APPLICATION. One of the most convenient methods of applying lubricants, especially where automatic feed of workpieces is available, is by flowing the lubricant over the work and tools through a circulating lubricant system. Where there is hand feed, a dipping method is also convenient. Fillers require agitation and high fat content to remain in suspension without clogging feed lines.

Oil-base lubricants used under these conditions are also more expensive because of the heavy drag-out due to high viscosity. Emulsion-type lubricants which may contain soap fats and reactive components but no filler are easily applied.

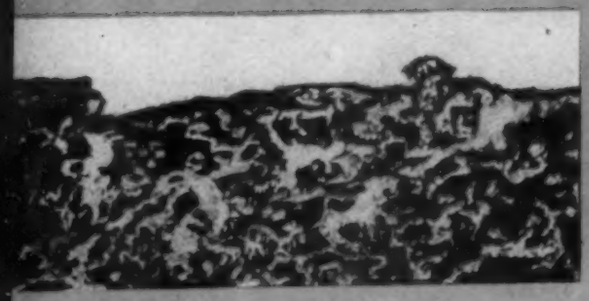
Application is more troublesome where low-melting solid lubricant, metal coatings or compound formed by reaction with sulphur-bearing lubricants must be deposited on metal surfaces. This has often prohibited their use in places where volume of work of any particular type is not very great. However, where the volume is high these methods are no more inconvenient and may be more desirable if lubrication can be performed by the use of mechanical equipment.

EASE OF REMOVAL. Lubricants are often selected on the basis of ease of removal even when other superior lubricants are available for the operation. Important as removal is, greatest emphasis should be placed on lubrication performance. It is usually possible to improve cleaning methods to get adequate removal of lubricant.

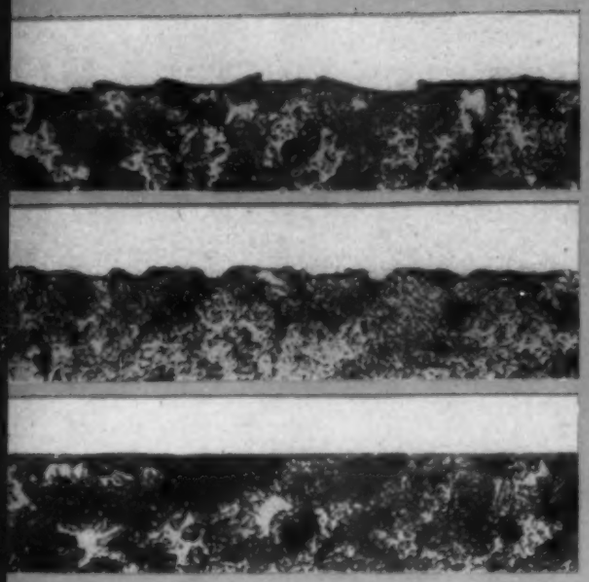
STABILITY. A lubricant should remain unchanged during its useful life, as in the sump of a forming press, and show no rancidity. Rancidity is especially bad with lubricants containing sulphurized oils, as the product of decomposition is hydrogen-sulphide gas. Care should be taken in using phenolic compounds to prevent rancidity, because some employees are allergic to these compounds.

A better method, especially where there is a central collecting tank for the lubricant, is to use a pasteurization process or allow the lubricant to flow under a battery of ultra-violet lamps. Lubricants which have been homogenized before procurement will not separate in emulsion; many manufacturers now supply lubricants in this condition.

The lubricant should not come in contact with extremes of temperature over extended periods of time because of partial separation of the emulsion. Separation can be prevented by careful mixing before application. The paste lubricant should be mixed with small quantities of water and kneaded and mixed until it suddenly becomes more free-flowing. Live steam should not be used for mixing.



This finish-turned steel surface, with a profileometer reading of 145 microinches rms., indicates that even the best surfaces make contact at relatively few points, a fact which increases tendency toward buildup in drawing



Three stages in reducing the irregularities on a metal surface show that the best surface will be obtained by good grinding and polishing practice rather than by burnishing the surface, which merely hides the defects. Burnishing should only be used after the surface has been ground and polished. Final finish in this sequence is 0.9 microinches rms.

A result of welding is this torn surface, shown with a vertical magnification of 2000. Here copper has been allowed to slide on an unlubricated steel surface and "hunks" of the softer metal have been torn out. Pits marked *H* show where steel has been plucked out of the surface

NON-CORROSIVE. Lubricants should be checked for corrosion when high concentrations of free fatty acids or extreme-pressure additives are present. In the case of aluminum and zinc, highly alkaline lubricants should be avoided because they tend to corrode and mar the surface. Safe practice is to follow drawing with cleaning to remove lubricant and possible corrosion.

Types of Drawing Compounds

1. *Soap-and water dispersions.* Solutions of soap and water are one of the most widely used drawing compounds, and lubrication is supplied almost entirely by acid soap, present as a dispersed insoluble powder resulting from hydrolysis of the soap.

This hydrolysis is the cause of the high alkalinity of "neutral" soaps when dispersed in water at low concentrations. Any excess of alkali should be avoided because it prevents hydrolysis. Free alkali should be kept below 0.08% (calculated as NaOH) for good lubrication. The acid soap is only slightly soluble and extent of its formation depends upon concentration and temperature; lower concentration and higher temperature gives greater hydrolysis.

Soaps generally recommended for drawing lubricants have fatty acids of relatively high titer (solidification point), made from fats rather than oils. As the acid soaps are less soluble than those formed from low solidification-point fatty acids, this is proper, but any soap can be used if maximum hydrolysis is attained by low concentrations.

Complete hydrolysis can be attained by sufficient dilution, but it should not be carried too far so that some unhydrolyzed soap is free to disperse the acid soap to the metal surfaces. Many metal-forming plants consider that a soap having a heavy gel structure is necessary and use the "slippery feeling" as a criterion. While soaps forming heavy gels are the most effective producers of acid soap, it is best to use these soaps at such a low concentration that the gel structure does not form. The heavy gel itself, or "slippery feel," is not important to good lubrication, and may even impede pumping of lubricant through the system.

Frankford Practice

Carefully followed practice at Frankford Arsenal is to store soap dispersions, after solution of the soap, for from one to three days before application, which:

1. allows hydrolysis to continue to equilibrium,
2. causes additional acid soap formation to take place on the soap,
3. reduces curdiness in the soap, permitting better pumping.

Dilution of this gelled soap (2-3% high-titer soap), providing a 0.4 to 0.7% soap solution, gives better tool life and lower draw forces in drawing brass cases. At this concentration gel structure is practically absent.

2. *Soap, fatty acids and water.* Because the effective constituent of soap dispersions is the acid soap, addition of fatty acids should give better lubricants. This has been verified in the laboratory, but has not yet been employed widely in industry. It is believed that addition of stearic acid where the free alkali of the soap is high or the soap is of the low-titer type, may help.

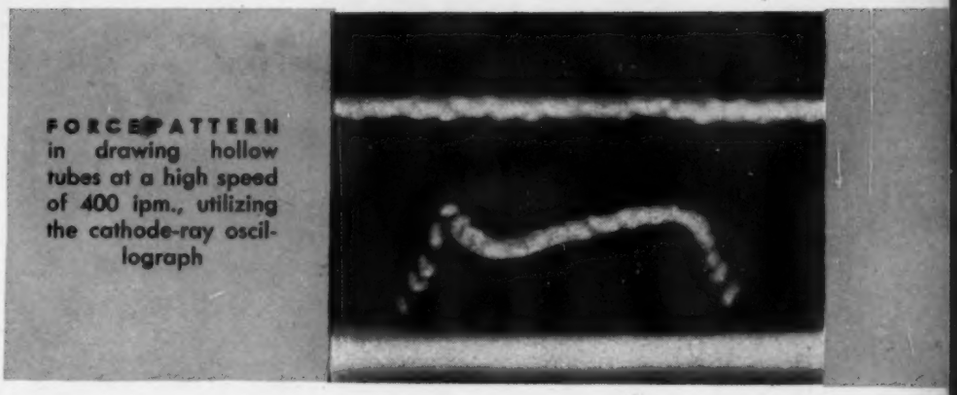
3. *Soap, fatty oil or fat, free fatty acid and water.* This type is used widely and is usually purchased as a paste and diluted with water in the shop. Free fatty acid may be added, but fatty materials partially decomposed into fatty acids provide cheaper lubricants. Where free fatty

acid is added it should be as stearic acid rather than oleic acid (red oil). Free acid should be added to the lubricant just short of point where corrosion begins, at least 2% and predominantly stearic acid. Fatty acid is supposed to "wet" the metal, but more likely the soap and fatty material provide some lubrication by formation of polar adsorbed films.

Relatively large variations in soap and fat content usually cause little change in lubrication properties, and it appears that one of the main functions of the fat or fatty oil is to form an emulsion with the soap and inhibit the natural foaming tendencies of the soap dispersion. The use of soap dispersions in conjunction with an anti-foaming agent is equally as satisfactory as this conventional type of drawing lubricant at a small fraction of the cost.

4. *Soap, mineral oil and water.* In these lubricants, formation of an emulsion changes physical properties of the soap and adds to foam reduction but the soap is still the sole source of fatty acids. This type has been used mainly as a coolant.

5. *Soaps, mineral oil, fatty acids and water.* Mineral oil is a vehicle for the fatty acids and changes physical properties of the soap by formation of an emulsion. Some of these lubricants equal in performance the emulsions containing fatty material. Absence of fatty material should reduce lubricant cost and rancidity. Mineral oil is often partially substituted for the fatty material and intended as an adulterant.



FORCE PATTERN in drawing hollow tubes at a high speed of 400 ipm., utilizing the cathode-ray oscillograph

6. *Reactive-component lubricants.* Lubricants listed in 1 to 5 may be used as the basic material for other constituents for lubrication in severe drawing operations. Reactive constituents used are oils containing sulphur, chlorine and phosphorus sometimes with fillers. Sulphur is the most widely used, and compounds are available containing it, the degree of reactivity required increasing with severity of drawing.

The types of chlorine- and phosphorus-bearing additives tested by the writer lose practically all of their extreme-pressure lubrication properties on being added to emulsions containing soap. However, effective drawing lubricants for severe work have been made by using sulphurized lard oil (or other sulphurized fatty oils) in which the sulphur is less reactive, and sulphurized mineral oils in which the sulphur is more reactive. Occasionally, elementary sulphur, such as flowers of sulphur, is used in heavy-duty water-base drawing lubricants to yield a quite reactive extreme-pressure-lubrication composition. Here the sulphur is also acting as a filler. Sulphur should be removed before heating because it could affect the properties of the metal.

7. *Lubricants plus fillers.* Fillers most frequently used are: chalk (whiting), lithopone, zinc oxide, clay (bentonite), white lead, flour, yeast, bran talc, graphite and mica. These materials mechanically separate the metal surfaces insofar as they can adhere or be trapped between these surfaces under high shearing stresses. It is usually necessary to use the above emulsions in concentrated forms to increase viscosity, retard sedimentation and keep the filler in the sphere of action. Starch, flour, gelatin, and sodium alginate can increase viscosity of the medium.

Two types of inorganic fillers are used, those that pulverize under high pressure and those having weak cleavage planes permitting slippage along these planes under high shearing stresses. The former type, such as chalk, lithopone and white lead, results in greater lubricant friction but is probably better as a mechanical separator of sliding surfaces. In the latter case, the force required to cause slippage at the weak cleavage planes is relatively small. In certain types of wire drawing, bran, flour, yeast, and beer (less sediment), are used as fillers, the last two primarily in Germany and France.

8. *Lubricants with emulsifying agents other than soap.* Sulphonated compounds and triethanolamine

TYPICAL PRODUCTION DRAWING TEST

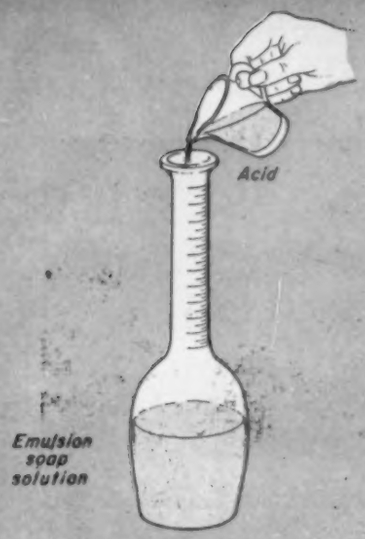
LUBRICANT	TEST 1	TEST 2	TEST 3
A	9,141	11,121	.....
B	4,785	7,854	8,415
C	7,029	7,590	.....
D	10,294	13,859	.....
E	26,048	19,584	.....
FF	400	385	.....
G	541	626	.....
H	302	329	.....
I	7,000	34,000	7,000

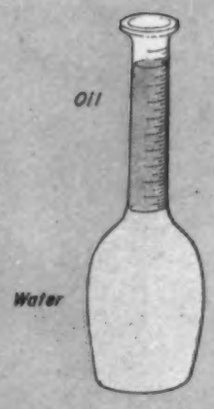
Lubricants A to D, inclusive, were tested as a group, whereas the others were tested with varying tools and drawpieces. Lubricant results were the same as those obtained from Falex test data, except for D.

Evaluation here is on number of steel case pieces drawn prior to formation of visible scratches on the work.

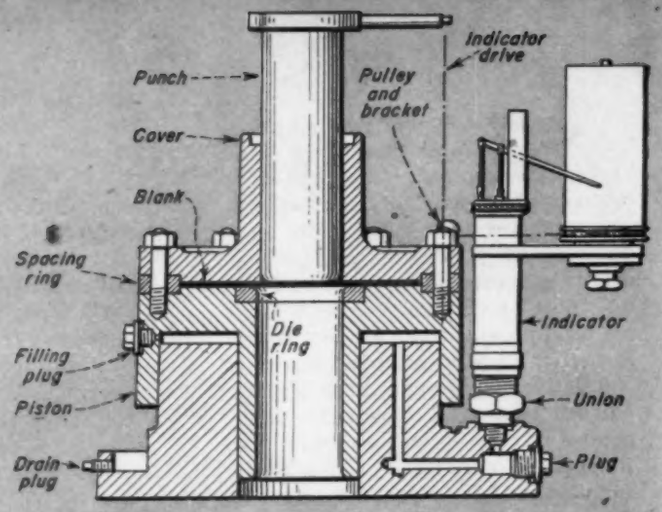
COMPARATIVE DATA ON STEEL AND CARBIDE DIES

LUBRICANT	TOOL LIFE	
	STEEL DIES	CARBIDE DIES
A	1 to 50	16,000
B	2100	134,000
C	1800-2600	130,000





CONCENTRATION TESTS may be readily performed in the shop by breaking an emulsion or decomposing a soap solution. Hydrochloric acid is used to break the emulsion and glycerine is added to give the water greater density. Heat is applied to increase mobility of the oily matter, which floats on top of the water and can be readily estimated by the graduations



THE SWIFT METHOD for determining required force has a disk cupped in a sub-press assembly which is used to transmit force through a hydraulic system to an engine indicator. This actually is a shaping rather than a drawing operation on 0.036-in. steel stock

soaps may be used as emulsifying agents instead of soap, particularly with hard water. Triethanolamine soaps should not be used in drawing brass, copper or zinc because they cause stress corrosion cracking. These emulsifying agents have good surface active properties.

9. *Mineral Oil.* Mineral oil alone can only be used for very mild drawing operations, and it loses boundary lubrication properties if refined too highly. Mineral oil obtained from some crude oils such as "smackover crudes," contains relatively large amounts of low-reactivity sulphur and imparts slight extreme-pressure properties. Cooling properties of petroleum-base lubricants are dependent to a considerable extent upon the viscosity of the oil, which should be low, (60 to 100 sec. S.U.V. at 100 F.) for better cooling, although not so low that the flash point is below 275 F.

10. *Fatty oil.* Lard oil is frequently used in deep-drawing operations. As water-base lubricants can be substituted for fatty oils without loss in performance, fatty oils are rapidly being displaced on the basis of cost and ease of removal. Mixtures of fatty oil and mineral oil may be used at lower cost and with less gumming and rancidity.

11. *Oil-base lubricants plus reactive constituents.* Additives containing sulphur, chlorine or phosphorus are frequently incorporated into the oil lubricants just discussed to supply lubrication under more severe drawing conditions. Minor percentages of fatty oil may be used advantageously, the mineral oil acting as a vehicle for the reactive constituent to form a separating film and the fatty oil yielding a polar lubricant to reduce friction.

12. *Oil-base lubricants containing fillers.* Fillers may be added to increase weld-preventive properties. Chalk (whiting) is now used extensively as a filler and frequently lithopone is used as a substitute for white lead. Other fillers are talc, graphite and mica. Graphite is available in colloidal dispersed form (Oildag), which does not settle out.

13. *Low-melting solid lubricants.* (a) Dry Soap. In wire drawing where a "sull" or rust and lime-coating is used, powdered soaps are applied at the dies as the lubricant, and the wire is allowed to dip into the soap powder which adheres to the wire. This is carried to the dies and converted to an adherent coating which frequently enables the wire to be drawn through several dies without relubrication.

The soap powder must be resistant to absorption of water in the atmosphere to maintain adherence properties and should be substantially free of glycerine. Soap builders such as soda ash or borax are frequently added. These built-up soaps are relatively ineffective in water media because of the prevention of hydrolysis by the excess alkali of soap builders. Great care should therefore be exercised in attempting to use soaps in wet drawing which have been designed for dry wire drawing.

Soap coatings, dried onto the metal surface, are useful in some deep-drawing operations. These coatings should not be very thick, but an adequate coating is indicated by running the fingernail across the workpiece for 2 to 3 in., if a tiny soap particle appears on the edge of the nail. Excessively thick coatings tend to accumulate at the throat of the die and may cause some difficulties. Concentration of soap required in general should be about 5 to 10 oz. per gal. of a high-titer (tallow) soda soap. Built-up soaps, containing low percentage, should have an actual soap concentration of 3.7 oz. per gal.

Such soaps are being marketed for this application and are applied by dipping, flowing, spraying or tumbling in a tumbler or conical washing machine. In dipping, the pieces should be kept in contact with the hot soap solution at 180-200 F. long enough to become hot. After draining they may be allowed to dry while cooling or baked in a hot air oven at 200-300 F. In flowing or spraying, pieces must be baked in a hot-air oven. This method is not as economical as hot dipping but is more fool proof.

Dried soap coatings are usually not displaced on entering the die, effectively provide separation of the surfaces to prevent welding, and reduce lubricant friction for lower draw forces. Tool life is better than with liquid lubricants.

13. (b) *Waxes.* Waxes, either deposited from a solvent or from an

emulsion, have been used as drawing lubricants. When deposited from a solvent, precautions must be taken against inflammability and toxicity.

14. *High-melting Solid Lubricants* (a) Sulphide. Stable compounds, made up of sulphides or partially oxidized sulphides formed by the action of sulphurized oils or fats, which are heated with the metal with a considerable quantity of water, have been used on severe drawing operations. A layer of oily material formed at the same time prevents corrosion and reduces friction. A coolant is frequently circulated.

14. (b) Oxides. Coatings of rust formed so that the oxide is hydrated, and therefore not abrasive, are extensively used as deep-drawing lubricants in conjunction with liquid lubricants containing polar molecules, such as fatty acids. The sull coating used in the steel wire-drawing industry is of this type, with lime added, and baked to neutralize the acid used to cause the rust and to remove occluded hydrogen that embrittles the metal. Oxide coatings are also used extensively for drawing non-ferrous wire.

14. (c) Phosphates. Phosphate deposits, in conjunction with a liquid lubricant have been applied to many deep-drawing operations and are sometimes used without the liquid lubricant. These deposits develop high lubricant friction and should be used with polar lubricants.

15. *Metal Lubricants.* In certain severe drawing operations, especially with ferrous metal, a layer of a dissimilar ductile metal is frequently interposed between the work and tool. Copper, lead, zinc, and tin have been used, application being by electroplating, or hot dipping.

Non-ferrous metals such as aluminum, copper, brass and lead are also used in powder form as fillers incorporated into water- or oil-base lubricants.

In this latter type, all that is required is a dip of one metal into a solution of another metal, appropriately selected, which results in a thin layer of the second metal depositing from the solution onto the first metal. Iron placed in an acid-copper-sulphate solution gives a coating of metallic copper. For an adherent coating, the conditions must be carefully selected. An inhibited copper sulphate is on the market under the trade name of "Cuprodine Salts" which give a bright, adherent, displacement on steel.

Drawing-Lubricant Tests

Chemical Methods of Testing

Most standard tests are available in textbooks on chemical analysis. However, three tests of an approximate nature, for concentration of soap or emulsion, sulphur activity and rate of sedimentation of filler, may be carried out in the shop.

Emulsion Test

Concentration control in the shop is aided by determination of the amount of oily matter which can be obtained by breaking the emulsion or decomposing a soap solution. A flask or cylinder, with ruled graduations, provides a direct measurement of the volume of oily matter broken down from the lubricant by acid.

A known volume of the solution or emulsion is placed in the graduated cylinder (Babcock flask). Enough acid is added to break the emulsion and decompose the soap and a fair amount of either salt or glycerine is added to increase the density of the water solution and cause the fatty matter to rise.

Sulphur Activity Test

A rapid test for the type and activity of the sulphur in an oil-base lubricant requires only a source of heat, a thermometer and a few strips of polished brass. The oil is heated to 100 C. and a piece of polished copper strip inserted. If the strip becomes blackened in 1 to 3 min., sulphur is present in an active or corrosive form of characteristic sulphurized mineral oil. If the copper does not become blackened at 100 C. but does become blackened around 150-200 C., sulphur is present as a non-corrosive sulphurized fatty oil.

Filler Sedimentation

Rate at which the filler in a filler-bearing emulsion lubricant will settle during use may be obtained by placing a sample of the lubricant in a graduated cylinder, and determining the volume of filler which settles out after varying periods of time.

Physical Methods of Testing Drawing Lubricants

Aside from the use of standard lubricant-testing machines, the type of testing most suitable for production shops and most widely used for this field involves an operation similar to that used in production drawing with the use of some arrangement for measuring the forces required for the operation.

Force-Measuring Methods

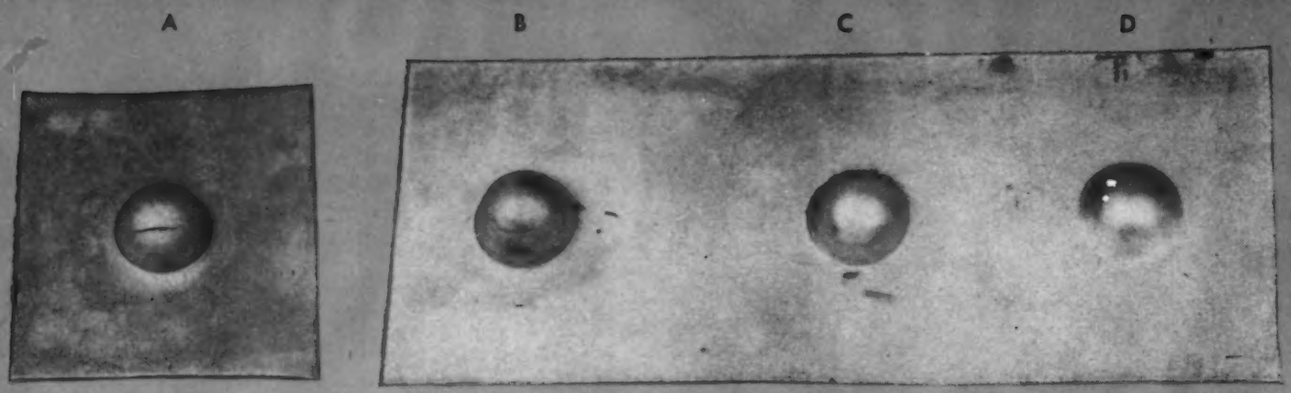
In this type of measurement, an attempt is made to determine the force required to perform a specified drawing operation. Three methods used are:

(a) *The Williams method,* in which wire is drawn through a die fixed in a plate constructed so deflection of the plate can be measured for an estimate of required drawing force. In addition, the back-pull on the wire is determined by a spring balance.

(b) *The Swift method,* in which a disk is cupped in a sub-press assem-

FACTORS IN ANALYSIS OF DRAWING LUBRICANTS

OIL-BASE LUBRICANT	WATER-BASE LUBRICANT
Viscosity	% water
Viscosity index	% free alkali
% fatty matter (saponified fats or fatty oils)	% fatty matter (fats or fatty oils)
% mineral oil (unsaponifiable)	% unsaponifiable (mineral oil or wax)
% free fatty acid iodine number (saponification number)	% soap (titer of soap)
% filler (characteristics of filler) type cleavage or friable particle size	% free fatty acid
% sulphur	% filler (characteristics of filler)
% reactive sulphur	% insoluble in alcohol (inorganic salts)
% sulphur in fatty oil	% (sulphur, chlorine or phosphorus) and their characteristics
% chlorine or phosphorus	



Drawability of a metal can be determined by the Parkinson method in which the Erickson or Olsen cup-testing machine is used. Here *A* is a preformed cup before lubricant is applied, *B* the result with poor lubricant, *C* a moderately good lubricant and *D* the result with a good lubricant. This method has been most successful with brass

bly which is used to transmit the force through a hydraulic system to an engine indicator. Being a cupping operation on 0.036-in. stock, this operation involves shaping to a greater extent than actual drawing.

(c) *The Frankford Arsenal method,* in which cartridge-case pieces are drawn in a sub-press assembly in a tensile-testing machine used in compression. This can be used for cupping, but most of the data have been obtained in a redrawing operation by sinking a heavy-based cup and ironing the side wall rather extensively. This results in a force-pattern diagram which involves as its first stage the sinking operation that causes a sharp maximum deformation force, followed by a longer wall ironing operation involving a more gradually increasing force.

Most of the data for both the Swift and Frankford Arsenal methods were obtained at low speeds, the former at 1½ i.p.m., and the latter at 3 i.p.m. This is done for expediency, as most press work is done at higher speeds and greater heat concentration on the tools. It is sometimes possible to use these methods at high speeds, and Swift actually inserted his sub-press assembly into high-speed presses for a small amount of work. The Frankford Arsenal method can also be used at high speeds by winding strain-gage wire around the die and attaching this to a cathode-ray oscillograph. A force-pattern curve obtained by this method by Dr. T. A. Read at Frankford Arsenal is given in an accompanying photograph and it agrees with the form of the low-speed curve. The influence of speed may not be apparent until a long run has been made, and heat accumulated, which is inexpedient under experimental conditions.

Drawing-force measuring methods offer comparative ease of measurement with fairly precise quantitative data for analysis. In these measurements the major portion of draw force measured is that required for deformation of metal and is not due to friction.

If the force required to overcome frictional resistance is due mainly to the breaking of the welds between work and tools, then this may be used as an estimate of the tendency for build-up to occur. Where build-up does occur, higher forces are required because of widespread welding. Limitation of this method is the lack of build-up under test conditions because of the small amount of work processed.

Drawability Methods

In the Parkinson method, the Erickson or Olsen cup testing machine is used to make a cup under lubricated conditions. This test is performed as follows: A steel ball 0.875 in. in dia. forces a strip of sheet metal approximately 0.042 in. thick through a steel ring 1 in. in diameter. A shallow cup is preformed to a height of 0.28 in. The lubricant is then applied on the inside of the cup and the cupping continued until there is a pressure drop or visible necking.

The height of the cup or fracture and the distance from the base of the cup to the point of fracture should be high for good lubrication. Some data obtained in the drawing of brass by this method agree fairly well with data obtained by other methods. However, the writer has not had great success with this test in drawing steel. Parkinson, however, has used it thus successfully.

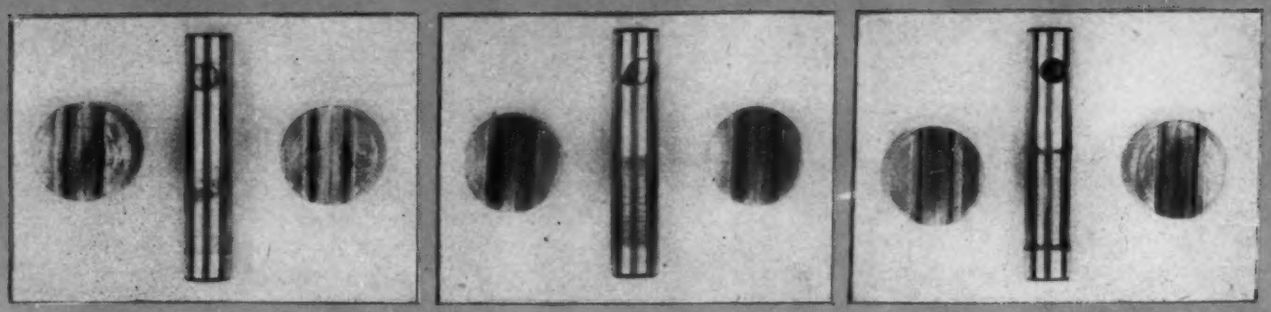
E. P. Testing Methods

The Falex machine, manufactured by the Faville-LeValley Corp., has been most widely used in testing extreme-pressure lubricants. It consists of a rotating steel pin and four V-shaped bushings which initially make line contact at four lines. Because of this small area of contact, unit pressures between the parts can be very high, even though the total force pressing the parts together is only moderately high. The bushings are pressed against the rotating steel pins by two nut-cracker jaws through which the load is applied by the compression of a spring which brings the jaws closer together. The bushings and pins are immersed in a lubricant cup holding about 55 cc. of lubricant. The spring which presses the jaws together is attached to a gage which gives the load.

While the torque of the assembly is measured to give an estimate of frictional force, this is not very accurate. The criteria of failure are in the main the wear on the bushing and pins which are measured either by the width of the wear scar or by the amount that springs must be compressed additionally in order to restore the initial load at the beginning of a test-running period.

This machine has been used to test drawing lubricants with somewhat different procedures at the Crown Cork & Seal Company, Baltimore, and the Frankford Arsenal. Essentially, an attempt is made to determine the point at which a sharp increase in wear occurs, but Crown Cork & Seal attempts to determine the specific pressure at which this increased rate of wear occurs.

In interpreting data, two things must be considered: (a) in some systems of lubrication during drawing, coatings on the metal provide the major portion of extreme-pressure lubrication characteristics rather than the liquid lubricant and it should not be rejected for this reason, and (b) heat concentration in the Falex test is higher than all but



The Falex machine is most frequently used for testing of extreme pressure lubricants and consists of rotating steel pins and v-shaped bushings. Bushings are pressed against the rotating steel pins and lubricant is evaluated by checking the amount of visible wear as shown in the three samples

the most severe drawing operations. Thus, certain lubricants giving good test results through heat-induced reaction might not perform as well in lower-heat-production methods.

The Falex machine test with specific procedures as at the Crown Cork & Seal Company and Frankford Arsenal Laboratories has aided the development of new drawing lubricants for severe operation. However, this type of testing does not account for the influence of work surfaces. This condition frequently determines the amount of drawing difficulty. In addition, it is not possible to evaluate surface treatment as an aid to lubrication in drawing. Moreover, it is not possible to utilize this type of testing for evaluating solid coatings of lubricants such as dried soap film, etc. Within its scope, however, this type of testing has proved very valuable.

Shop Tests

Conclusions derived from any chemical or physical test described should be checked wherever possible by press tests under controlled conditions. In these press tests, several factors in procedure should be considered:

TOOL LIFE STANDARD. One system involves a count (by weight, truckload or actual number) of pieces drawn prior to the first scratches that may be felt by rubbing the fiingernail over the region. A count of the pieces prior to scrapping of the tools is, unfortunately, more frequently used. This is a dangerous practice because too much metal must be removed in reconditioning the tools after visible build-up has started. It is also difficult to establish any standard of tool life because the skill of the polisher affects any analysis.

NUMBER OF TESTS. The amount of control possible over mechanical and other variables determines the number of tests. Two or three repeat tests are adequate under well-controlled conditions, but under most production conditions test may have to be run over a week or several weeks to average the results. Representative data obtained in a high-speed draw press (90 strokes per min.) in one of the drawing operations on steel cartridge cases is given in an accompanying table.

These data indicate that fairly good reproductibility can be obtained, but occasionally a sharp departure occurs, which, while discouraging, does not minimize the value of experiment on lubricant variation. The data conformed fairly well with those obtained with the same lubricants using the Frankford Arsenal procedure.

COMPARATIVE TESTS. Most press tests involve comparison of a group of lubricants under as nearly identical conditions as possible. To compare another group, at least one member of the first group should be retested. One recurring difficulty in this type of testing is that the same tools cannot be used for more than a very limited number of tests.

Lack of absolute values because of difficulty of evaluation of any specific operation and change of mechanical variables over a period of several months puts comparative testing under a handicap. This can be partially compensated for by accumulation of data on laboratory devices which can be better controlled and give a more general picture.

Press tests on tungsten-carbide dies have been too costly for most production plants. However, experience has shown that comparisons of lubricants for steel dies are valid for carbide dies in most instances. Differences can be anticipated by considering properties of the various die materials.

Selection of Drawing Compounds

The major factors determining the specific selection of a lubricant are type and severity of drawing operations. Properties of metals influencing selection of a drawing lubricant are: (a) coefficient of friction, (b) yield or plastic deformation strength, (c) rate of work hardening, (d) tendency for formation of surface films, (e) rate of reaction with the lubricant, and, (f) the surface condition.

Quality of the lubricant should be improved as the coefficient of friction, yield strength and rate of work-hardening increase. Formation of surface films such as oxide coatings facilitates lubrication, but excessively thick films of oxide will crack during the forming operation.

Of these factors, the one that can be most readily varied to improve general lubrication is yield strength, which can be reduced by proper annealing cycles. Where increasingly better lubricants are applied without solution of lubricant problems, yield strength should be lowered. Pickling procedure alters surface conditions for greater ease of drawing.

As a basis for selection of lubricants, a thumbnail classification on the basis of severity is useful. Thus, shaping operations, in which wall thickness is reduced only slightly or not at all, are much less severe than where the wall thickness is greatly reduced by ironing or forcing the metal into a restricted area between two tool surfaces. Operations will be classified by severity as:

Mild—Shaping under good conditions.

Medium—Severe shaping or sinking, as in wire drawing.

Severe—Ironing of metal as in seamless-tube drawing or cartridge-case manufacture.

STEEL. Steel drawing varies widely because of composition and types of operations. However, there is a balance between the factors determining severity of operation and the drawing lubricant that prevents lubrication difficulties. A good lubricant permits greater variation in other conditions.

Many seemingly mild operations become more severe when the metal is harder than normal or when tool design is poor. Operations with little wall-thickness reduction become severe when drawing takes place over a small area.

Good drawing practice on steel requires scale to be removed from the surface, slightly roughened by pickling with a minimum of hydrogen embrittlement. This may be reduced by pickling inhibitors, mild heating (250-400 F.) for 5 to 30 min. or several-hours storage at room temperature.

BRASS. The high ductility of brass makes it relatively easy to draw and it readily forms a protective coating in normal atmospheres. A mild pickling operation, followed by an alkaline wash, prevents the more ductile type of brass from taking too thick a coat of cupric oxide (black or brown). Pink or red stains of cuprous oxide, indicate that the coating may be too thick, and annealing-furnace atmosphere should be oxidizing. These stains may be removed by adding ferric sulphate to the pickling bath. Nitric acid or dichromate pickling should be avoided.

MAGNESIUM. Drawing lubricants for magnesium should not decompose at the relatively high heat involved. When graphite is used, it should be removed immediately after drawing to prevent pitting. Chromic acid (15-20%) with an intermediate alkaline cleaning where greasy lubricants are used, is recommended.

ALUMINUM. Build-up on tools is greater with aluminum than any other metal. Light pickling will prevent the oxide coating from becoming too thick. Alkaline lubricants are not recommended but, if used, should be removed after the draw. Soap-base lubricants will also attack aluminum.

STAINLESS STEEL. Drawing of stainless steel is difficult for three reasons:

(a) Tendency for welding and build-up is greater than for plain carbon steels

(b) Draw forces are higher than for equivalent plain carbon steels

(c) Greater tendency to work hardening.

Tools should be kept highly polished and lubricants of high separation characteristics should be used. Sulphurized lubricants have been avoided because of embrittlement during annealing if slight amounts of lubricant are not removed.

DRAWING-COMPOUND RECOMMENDATIONS

STEEL

Mild

Most automobile body forming and shallow draws on low-carbon steel.

1. Mineral oil of medium-heavy to heavy viscosity.
2. Soap solutions (0.03 to 2.0%, high titer soap).
3. Fat, fatty oil or fatty and mineral-oil emulsions in soap-base emulsions.
4. Lard oil or other fatty oil blends (10-30% fatty oil).

Medium

Deep draws on low-carbon sheet steel and drawing wire of low-carbon steel.

1. Fat or oil in soap-base emulsions containing finely divided fillers such as whiting or lithopone.
2. Fat or oil in soap-base emulsions containing sulphurized oils.
3. Fat or oil in soap-base emulsions with fillers and sulphurized oils.
4. Dissimilar metals deposited on steel plus emulsion lubricant or soap solution.
5. Rust or phosphate deposits plus emulsion lubricants or soap solution.
6. Dried soap film.

Severe

Wire drawing medium- to high-carbon steel, seamless-tube drawing and cartridge-case drawing.

1. Dried soap or wax film, with light rust, phosphate or dissimilar metal coatings.
2. Sulphide or phosphate coatings plus emulsions with finely divided fillers and sometimes sulphurized oils.
3. Emulsions lubricants containing flowers of sulphur as combination filler and sulphide former.
4. Oil-base sulphurized blends containing finely divided fillers.

STAINLESS STEEL

Mild

1. Corn oil or castor oil.
2. Castor oil plus emulsified soap.
3. Waxed or oiled paper.

Medium

1. Powdered graphite, suspension dried on work before operation (to be removed before annealing).
2. Filler bearing emulsion lubricant at heavy concentration.
3. Solid wax films.

Severe

1. Lithopone and boiled linseed oil.
2. White lead and linseed oil to a consistency of 600 W oil.

BRASS

Mild

1. Soap solution (0.03 to 2% high titer soap).
2. Fat or oil emulsions with soap emulsifier.
3. Lard-oil blends (10-20% lard oil in mineral oil).

Medium

1. Soap solution. Soap should be high titer (39-42%), fatty acids and free alkali should be less than 0.07%. Solution should be low concentration (0.3 to 1.0%) and lubricant should contact work at least 30 sec.
2. Fairly rich fat or fatty-oil emulsions with soap emulsifiers. Free fatty acid in the paste base, if diluted with 8 parts water, should be at least 2%.
3. Lard-oil blends (25-100% lard oil in mineral oil). Free fatty-acid content should be 1.5 to 5%. Addition of about 1% melted tallow, 0.25% stearic acid to 1 to 2% soap solution is desirable for med. to severe draws.

Severe

1. Soap solution of 0.3 to 1% or one of 1 to 2%, containing 1 to 2% tallow or 0.25% stearic acid. Lubricant and work should be in contact longer than with less-severe draws.
2. Rich lard-oil blends (75 to 100%).
3. Dried soap properly added.

In most instances, brass recommendations apply to copper, although copper welds more rapidly and requires more efficient lubrication than brass.

MAGNESIUM

Mild

1. Graphite (usually colloidal) in mineral oil, high flash point.
2. Beeswax or paraffin and tallow.

Medium

Flake or colloidal graphite in a volatile solvent such as carbon tetrachloride, naphtha or alcohol spread on the work and solvent-evaporated. Add 20% graphite in tallow on the die.

ALUMINUM

Mild

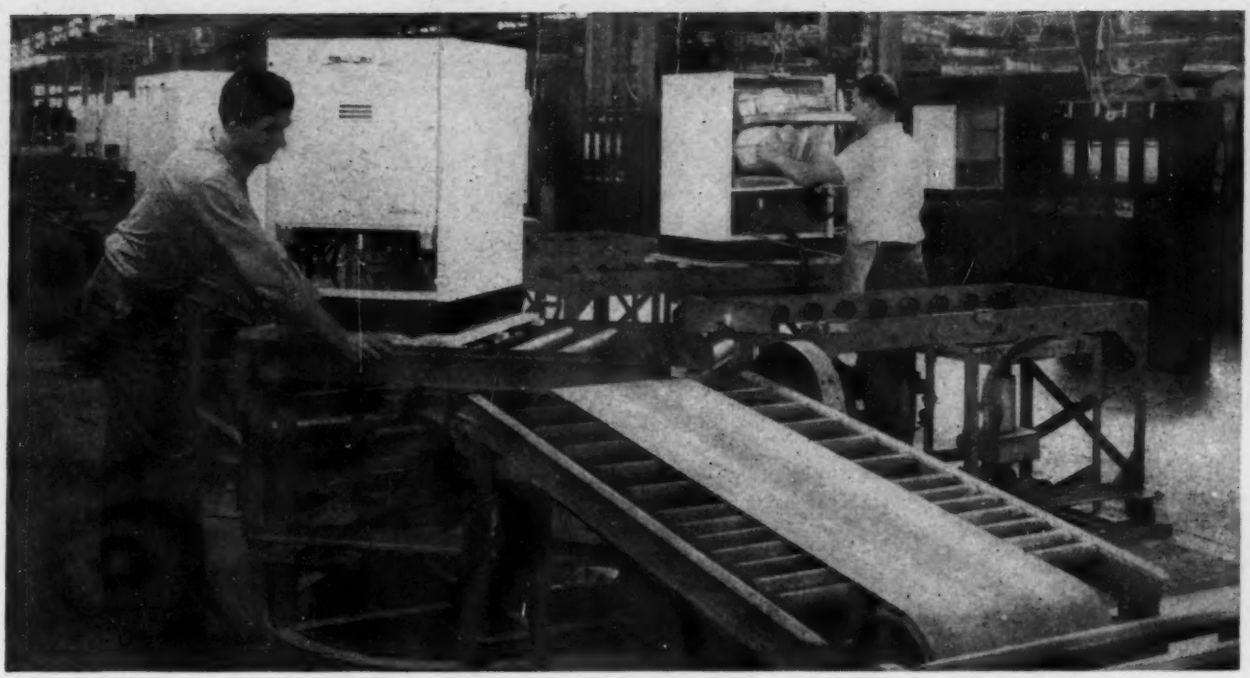
1. Mineral oil, increasing in viscosity as severity of operation increases.
2. Fatty oil blends in mineral oil (10-20% fatty oil) or petroleum jelly.

Medium

1. Tallow and paraffin.
2. Sulphurized fatty-oil blends (10-15%), preferably enriched with 10% fatty oil.

Severe

1. Dried soap film or wax films.
2. Mineral-oil or fatty-oil blends or sulphurized-oil blends, plus finely divided fillers.
3. Fat emulsions in soap water plus finely divided fillers.



Each turntable is mounted on four casters and has a Bassick lock to hold it in any desired position. Casters roll on a 1/4-in. thick steel circle to permit easy turing. Portable, conveyor-top test stands are set at right angles with the main conveyor lines opposite turntable units

Turntables Aid Assembly-Line Testing

BY BEN C. BROSHEER, ASSOCIATE EDITOR

MASS PRODUCTION of Hotpoint fully automatic electric dishwashers by Hotpoint, Inc. (formerly, Edison General Electric Appliance Company), is a postwar development. Although the company has made domestic electric dishwashers for more than a quarter of a century, prewar demand was too small to justify conveyorized production lines. Today, demand has risen to a level which makes it possible and practical to employ quantity production methods.

The plant, in which the dishwasher assembly line is located, was used until the end of the war for the manufacture of 0.50-cal. armor-piercing bullet cores. The dishwasher assembly department now occupies approximately 50,000 sq. ft. of factory space.

Only subassembly and assembly operations on automatic dishwashers are performed at this plant. Stamping operations involved in the production of body, tub, panel, door and other dishwasher parts, as well as the application of porcelain enamel and other finishes to these parts, are done at the company's range and water-heater factory.

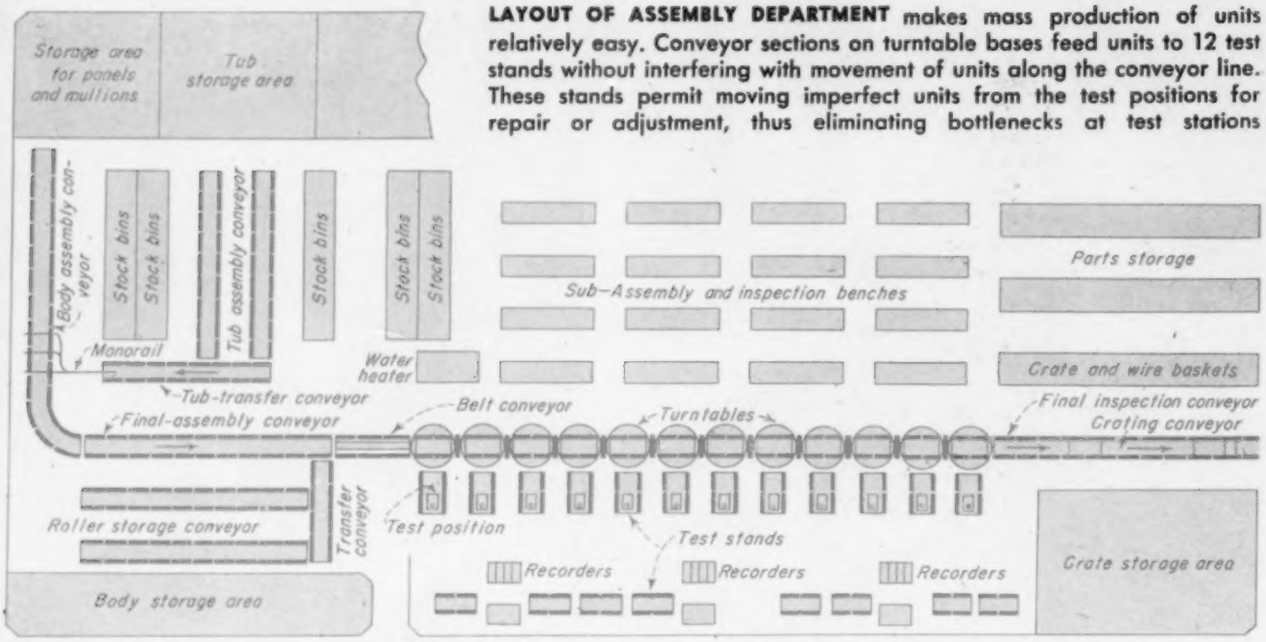
Every dishwasher must pass two complete running tests, each involving a complete check of every portion of the machine's automatic cycle. These tests require approximately 2 hr. for each unit. As any attempt to perform these tests on a conventional conveyorized assembly line would interfere with normal production flow, Hotpoint engineers have installed twelve novel turntable conveyor sections in the main assembly line.

Hotpoint dishwashers are quickly moved by conveyor turntables to test stands, avoiding inspection tie-ups on final-assembly line

Each turntable section is arranged so it can be turned about its vertical axis and a dishwasher unit on the turntable easily moved to a conveyor-top test stand placed perpendicular to the main conveyor line. The portable stands are positioned in rails above fixed test positions having all necessary electric, water and drain connections for complete running tests.

When a dishwasher has been moved to a test position and the turntable returned 90° to its original position, the main assembly line immediately is reopened to movement of units past that test position to any one of the other eleven test positions along the conveyor line.

Furthermore, should trouble be encountered when testing any dishwasher unit, the portable test stand on which it is mounted can be removed from the test position and



LAYOUT OF ASSEMBLY DEPARTMENT makes mass production of units relatively easy. Conveyor sections on turntable bases feed units to 12 test stands without interfering with movement of units along the conveyor line. These stands permit moving imperfect units from the test positions for repair or adjustment, thus eliminating bottlenecks at test stations

ASSEMBLY-LINE TESTING continued

taken to a repair area at the rear of the testing area. A spare test stand can be run into the open test position so regular testing operations can continue at that station.

Operating conditions during the two test runs are recorded on paper tape by 1,000-watt recording wattmeters, one of which is used for each test position. Wattmeters and other control instruments are mounted on recorder stands in the test area. A large insulated water heater near the assembly conveyor provides 150 F. hot water to the test positions.

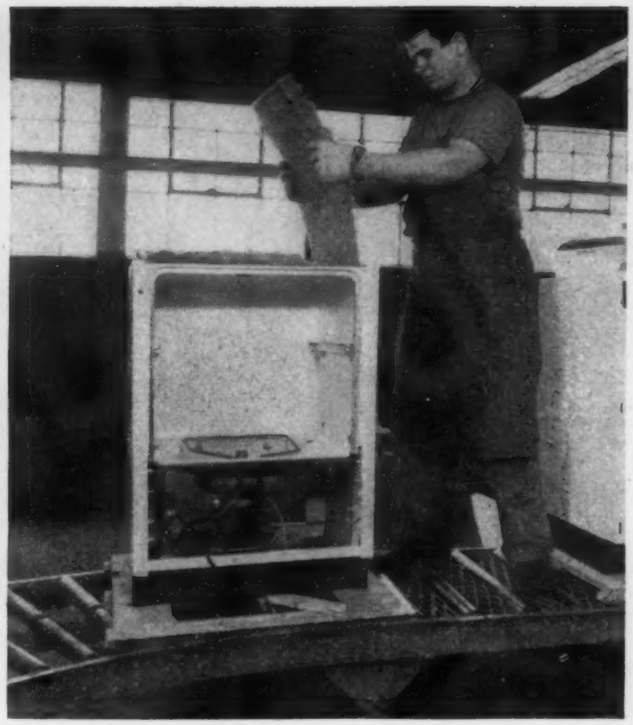
Assembly Layout

The layout sketch for the assembly department indicates the arrangement of the various conveyor units. Body subassemblies are delivered to the body-assembly roller conveyor, where they are placed on their backs on padded skids for the first assembly operations. As these skidded bodies are moved along the conveyor, they reach a position where a wood skid, which eventually becomes the base of the shipping crate, is bolted to the bottom of the body which is then turned 90° to place this skid on the conveyor rollers.

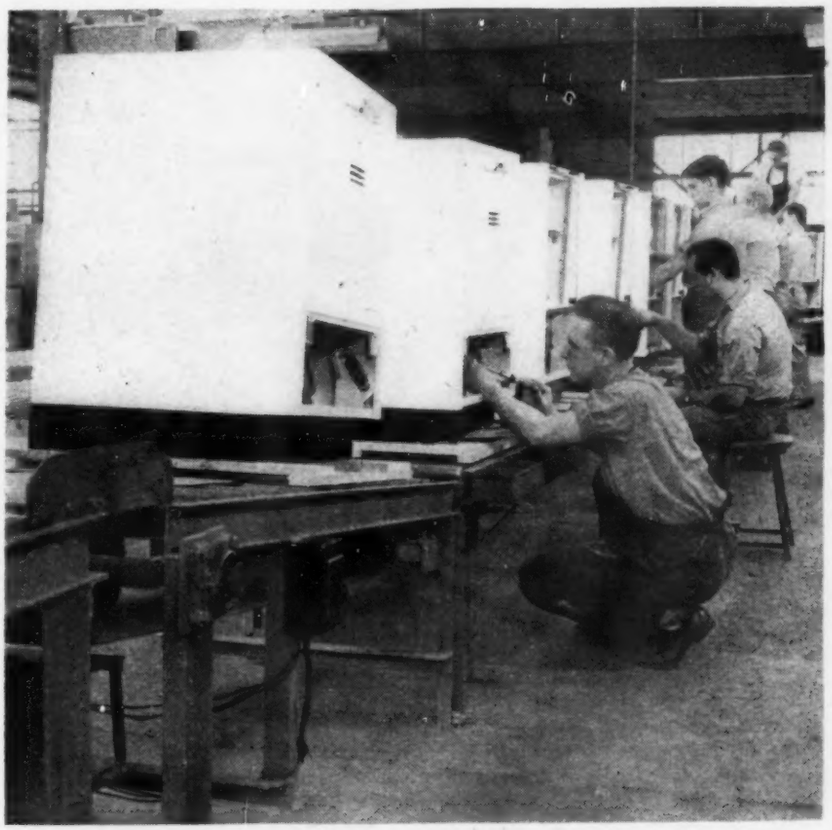
Next, assembled tub units are lifted to the body-assembly line with an electric hoist suspended from the trolley of an overhead monorail track. The monorail track, hung 10 ft. above the floor, is arranged with

Complete tub assemblies are lifted to the body-assembly line with an electric hoist suspended from a monorail track. This track permits delivery of tub assemblies to any one of three positions on the body conveyor. Jaws of the grab are lined with rubber to prevent damaging the enameled tub surface

Tub assemblies on plywood platens are completed on wheel conveyors. Parts trays, $4\frac{1}{2} \times 6\frac{3}{4} \times 3$ in., bolted on one side of the conveyor frame insure that small parts are available where needed. Adhesive tapes marked with part numbers identify the parts in each tray



A number of operations must be performed by workmen standing on the conveyor. To eliminate possible accidents, expanded metal strips have been placed between the 2-in. diameter rollers and set slightly below the roller tops so as not to interfere with movement of assemblies



Automatic diswasher units are moved by hand from station to station on the final assembly line in the Hotpoint plant. Parts trays mounted on the side of the conveyor frame save much assembly time

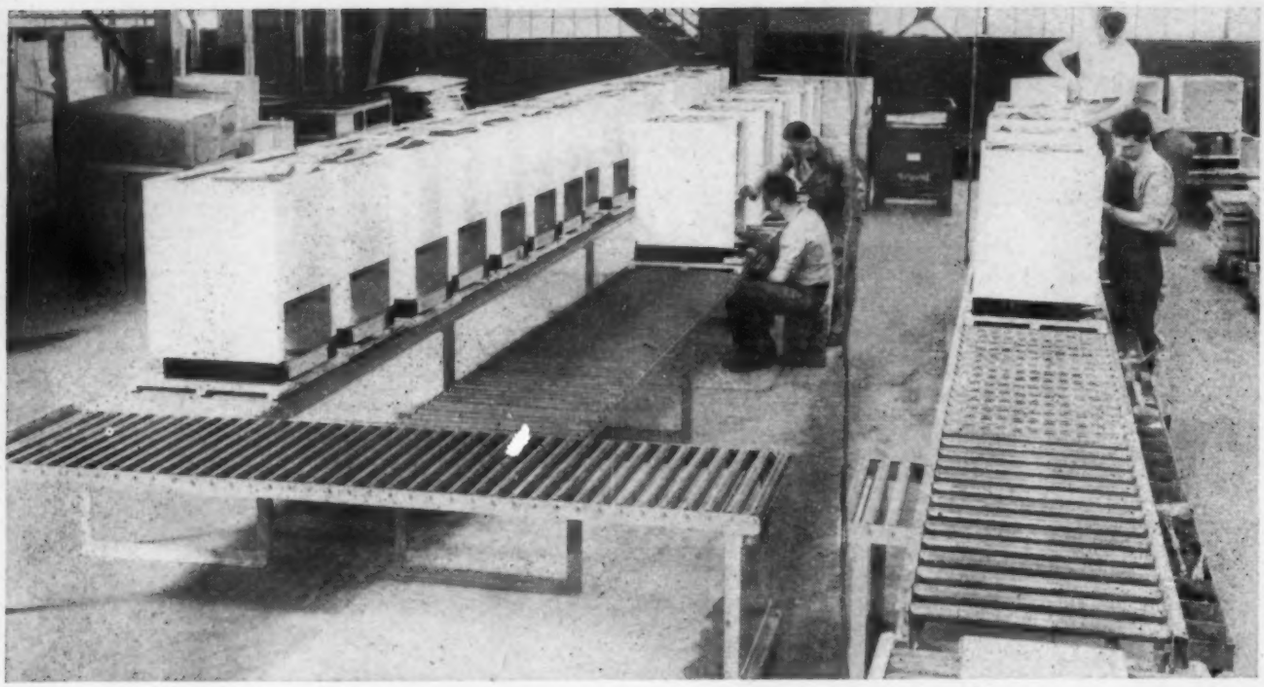
switches to permit delivering tub assemblies from the tub-transfer conveyor to anyone of three stations on the body-assembly conveyor.

Tubs are assembled on $28\frac{1}{2} \times 36$-in. plywood platens carried on two wheel conveyors set at right angles with the tub-transfer conveyor. Like the final-assembly conveyor, the two tub-assembly conveyors have parts bins, mounted on the side of the supporting frames, so workmen can keep their tools and necessary hardware parts convenient to their work stations.

Convenient Work Level

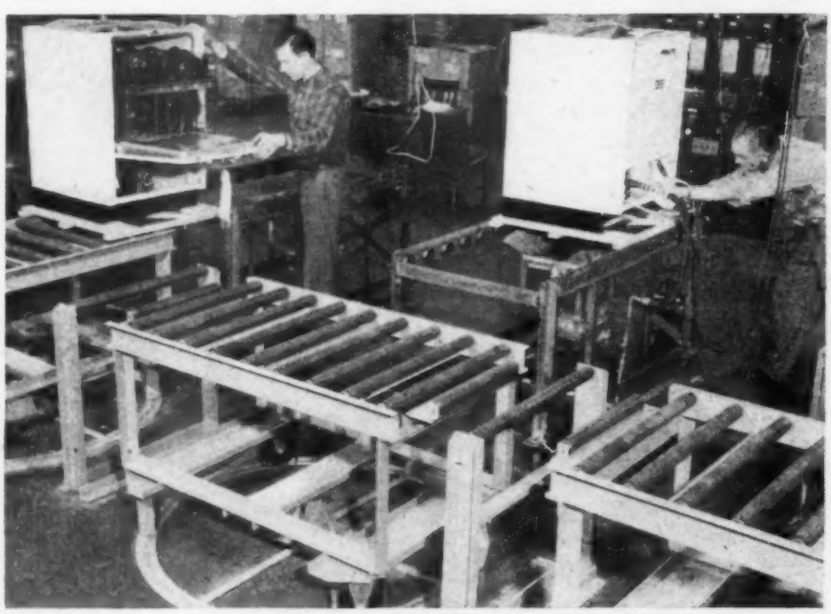
From the body-assembly conveyor, units move to a final-assembly roller conveyor for finishing operations. The tub-, body- and final-assembly conveyors are 24-in. above the floor so the work level is at the most convenient height. At the end of the final-assembly conveyor, a 6-ft. long power-driven belt conveyor elevates the dishwasher units to the 32-in. height of the conveyor sections on the turntable units that move the dishwashers to and from the twelve test positions.

Capacity of the assembly conveyors is somewhat greater than that of the test stands. An assembly



Overflow from the final-assembly conveyor (right) is transferred to two storage conveyors where dishwasher units are held until test-stand space is available. Some final-assembly operations can be performed on storage lines, making it possible to keep inspection line moving even when some parts are in short supply

ASSEMBLY-LINE TESTING continued



Each dishwasher unit must operate satisfactorily through two complete automatic cycles, with a wattmeter recording tape serving as the principal part of each test report. Each stand has all necessary connections for a complete check of each unit, including connection to a tank of test water at 150 F.

crew, therefore, can finish more dishwashers on one shift than the test crew can check during the same time. The overflow is moved from the final-assembly conveyor to either of two storage roller conveyors by a short transfer roller-conveyor section.

Dishwasher units moved to the storage conveyors are returned to the main conveyor line during the second shift when only a crew of testers are at work. The storage conveyors have another important advantage during these days of material shortages. Should any parts be in "short supply" for a time, washers assembled without these parts can be moved to the storage conveyors and missing parts mounted there when they are received in the plant.

Finished and tested units are moved along the main assembly line, across the turntable units, to a final-inspection roller conveyor where wire dish baskets are placed in position and the necessary visual and other final inspection checks are made. This section of roller conveyor also is 32 in. above the floor.

Because tests have shown that crating operations can be performed best when the conveyor is 24 in. above the floor, a short gravity roller conveyor lowers the finished units to a crating section of roller conveyor. At the end of this conveyor line, a sheet steel slide again lowers the crated units to a short section of roller conveyor only 8 in. above the floor. This last section has two roller legs on either side of a space left open for hand lift trucks with which the crated units are moved to storage.

ROUND TABLE

Snoopervisor

"Say, Al, I see you going around with a little black book. I don't think making notes on the job is such a good idea."

"Why, Ed? I can't keep all of the day's problems in my head, and I find it a lot easier to jot down requests and production information for checking on later."

"Sure, Al, I admit you can't keep everything in your head. But I mean making notes right on the job. I was talking to Frank Campbell during lunch and he told me that the boys he works with are starting to call his boss 'snoopervisor.'"

"Oh, I suppose they have pet names for all of us, Ed, but I don't think that is too serious."

"No, not just the fact that a nickname was used—but Frank told me why. He said that the little black book which his boss carried always seem to forecast trouble for somebody. No one has seen the inside of the book. His boss just comes up behind somebody, stands there a few minutes, takes out his black book, makes a few notes and walks off."

"You are talking about a different situation now, Ed. It isn't keeping a record—it is how that record is kept that makes the difference. I believe you have to keep your cards on the table. It isn't so much what you do, but what people *think* you do that makes their opinion."

"But, Al, that's the point! When you make notes on the job, somebody is bound to think you are snooping."

"That can be true, Ed, but I found a way to avoid suspicion: I make sure all the boys see the sort of thing I make notes about. I never put anything down in my book while I'm standing beside somebody without saying something to the man so he knows what I am writing. I often leave my book lying around so there is no mystery to it."

"But, Al, that seems like a lot of extra trouble. Once they know you are just keeping track of things to do and remember, they ought to relax on the whole idea. Or don't they trust you?"

"Ed, I think that being aboveboard with everything is one way to build trust. You can't take any chances with that. Most distrust is the result of misunderstanding. I think we take for granted that everyone knows what is going on just because we happen to have the information, but if you put yourself in the employee's shoes it helps to understand how he feels."

"How would you feel if your boss came around, watched you work awhile, made some notes in his book and walked off?"

"I wouldn't like it, Al, but that's different. He's only around here once in a while. Remember, I'm with my gang all day long, and they have no reason to suspect me of anything crooked."

"Still, Ed, there is no real difference. If your gang trusts you, it is because you work hard at keeping them tipped off on everything that goes on."

"Well, Al, I wouldn't take a chance if I was you. I'd rather throw my book away than have the fellows think I was snooping."

"I still don't believe there is any need to do that, Ed. It isn't the book but how I use it that makes the difference. If the boys decide I'm snoopy, the book, or no book, won't cut much ice."

***IS THERE ANY** real ground for Ed's worry about being called a "snoopervisor"? Is suspicion built up of little things like little black books? Have you any cases in point? Other readers will be interested in your experiences and opinions. Discussions of earlier topics appear on later pages.*

Liquid Nitriding INCREASES Tool Life

BY GEO. A. ROBERTS, CHIEF METALLURGIST, VANADIUM-ALLOYS STEEL COMPANY

Chip pickup and wear on high-speed steel tools are materially decreased by nitriding. Taps, chasers, reamers, form tools and broaches are most adaptable

HIGH SPEED steel tools which have been nitrided by the liquid-salt process attain a high hardness and wear resistance, a relatively low coeffcient of friction and a good resistance to softening at elevated temperatures. Ammonia-gas nitriding is time consuming and causes brittleness by concentrating nitrides on the steel surface. However, it may be used on some die work where brittleness is not a factor or where a deeper case is required.

The liquid process, in providing high hardness and wear resistance, materially lowers the abrading action of chip and work on the tool. Its low frictional characteristics serve to create less heat at and behind the tool point and help prevent chip pickup.

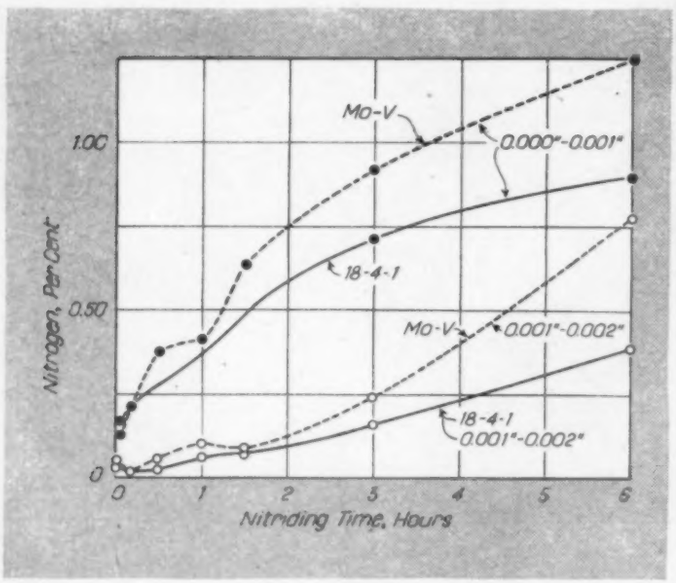
Effect of wear on tool life is most evident on those tools operating with light cuts such as taps, chasers, reamers and broaches. Load on the tool, particularly on chasers and reamers, increases rapidly as the tool becomes dull. Liquid nitriding of such tools improves their performance because of high hardness and low frictional characteristics, both of which prevent the wearing away of the sharp cutting edge.

Nitriding is also useful as a corrective measure when soft surfaces have been produced through improper grinding. However, it is not recommended for soft surfaces caused by decarburization, for it would result in highly brittle cutting edges.

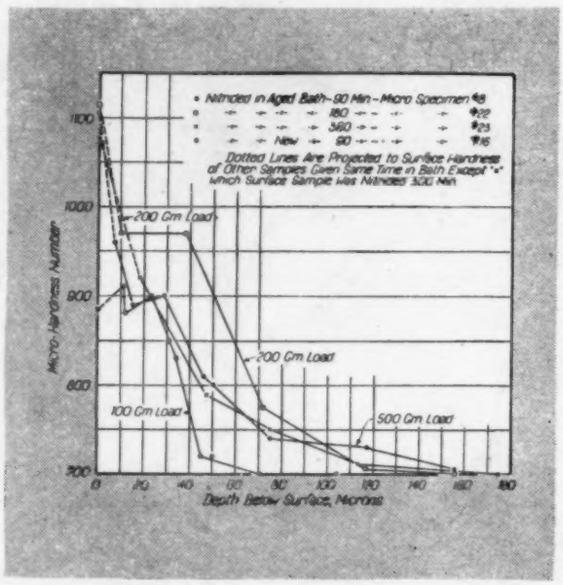
Twist drills and lathe, planer or shaper tools are least affected by nitriding, while greatest benefits are obtained on chasers, taps, reamers, form tools and broaches. Milling cutters and counterbores may at times be improved. Its application to precision-ground hobs may create objectionable movement or size change during reheating. This can be minimized by double tempering prior to nitriding to effect a complete conversion of retained austenite to martensite and subsequent modification of the latter to tempered martensite, and by holding the nitriding temperature lower than tempering temperature.

Nitriding may be beneficially applied to dies, particularly dies for drawing, dies subject to galling from the material being worked, or dies made useless by little wear.

One objection to nitriding has been that it is of little use because it is removed when the tool is resharpened. This is true for tools that are resharpened by grinding all surfaces of the cutting edge, such as lathe or planer tools. However, improvement of such tools by nitriding is questionable at any time.



Nitrogen content as a function of nitriding time is compared in the first and second 0.001-in. layers of two types of high-speed steel. *J. G. Morrison*



Hardness gradients, like nitrogen gradients, are high in this 18-4-1 high-speed steel. Change in hardness after 1 hr. of nitriding is not great. *Morrison and Gill*

Most fine-edge tools are sharpened by grinding only one edge, leaving the nitride condition on the other surfaces. Benefits from nitriding a cutting face probably result from a combination of increased hardness and resistance to wear, lowered friction and low chip pickup, while a nitrided case on the clearance face is of benefit mainly through its wear resistance and to some extent its lower friction. The majority of tools ground on only one face will be ground on the cutting face, leaving the nitrided case on the clearance face.

Nitriding Procedure

The hardened, tempered and ground tool should preferably be preheated in a neutral salt bath or an air convection furnace to a temperature of 1000-1050 F., transferred to the nitriding bath at approximately 1040-1050 F., and held for 20 to 30 min. in this bath. After the nitriding treatment the tools may be removed and air cooled, washed in warm water and dried.

While preheating is not necessary, it increases the efficiency and reproducibility of the treatment because time at nitriding temperature can be accurately controlled. If tools are placed directly in the nitriding bath, the cycle should be altered so the tool is at nitriding temperature from 10 to 20 min. Shorter times are recommended, as some nitriding will occur during heating.

For the majority of high-speed steels, the nitriding temperature will be identical with their tempering temperature. This suggests nitriding could serve a double purpose—tempering and nitriding being conducted simultaneously. This is possible, but the nitriding treatment should not be conducted on untempered tools because nitriding time is too short to permit thorough transformation of the retained austenite on cooling from the tempering temperature.

It is preferable to give at least a single standard tempering treatment to the tools before nitriding to convert retained austenite to martensite, which in turn will be tempered during nitriding. Thus, the hard case, 0.0005 in. to 0.003 in. thick, containing a high concentration of nitrides, is superimposed on a base metal having maximum or near-maximum hardness. Nitriding time may vary from 5 min. to 1 hr., depth of case and concentration of nitrogen increasing with time. Recommended optimum time cycle is from 20 to 30 min.

Typical nitriding equipment includes a preheat convection air furnace with automatic temperature control and an electrically heated pot furnace with an automatic two-point temperature control. Close temperature control is essential. The pot containing the nitriding salt should preferably be made of pressed steel and the thermocouple protection tube of 25 to 30% chromium iron.

Baths for high-speed steel are usually made up of a 60%-40% mixture of sodium cyanide (NaCN) and potassium cyanide (KCN) respectively, closely approximating the eutectic mixture at a 63-47 ratio which melts at 935 F. Proprietary nitriding mixtures can be obtained with an initial low melting point of about 850 F. and aged for use.

If these commerical baths are held at the operating temperature of 1000 to 1100 F. for approximately 12 hr., the cyanogen radical (CN) is oxidized to cyanate (CNO), the active agent of the bath which further decomposes to release free nitrogen and carbon monoxide (CO) and an end product, carbonate (CO_3). Cyanate content must reach at least 5-8% for successful nitriding because the free nitrogen and carbon monoxide supply the nitrogen and carbon which combine with and diffuse into the steel part being treated.

A bath originally composed of 70% sodium cyanide and 30% potassium cyanide will "age" in 12 hr. at 1050 F. to a cyanate content of 9%. The aging process also decreases the melting point so that when the cyanate reaches about 12% the melting point will be 755 F. Carbonate should be periodically removed from the bottom of the bath with a perforated spoon after lowering the bath temperature to 850 to 900 F. At this temperature the carbonate will "salt out".

The bath may become contaminated with nickel when nickel-alloy pots (35% nickel, 15% chromium) or pure nickel thermocouple tubes are used. Nickel in the bath will plate on the tool being nitrided to a thickness of about 0.00012 in., appearing as a white interrupted rim easily mistaken for carbide during microscopic examination and, at excessively long nitriding cycles, it may cause a crumbly layer 0.0002 in. thick. Such nickel plating will prevent the absorption of nitrogen in nitralloy steels when using dissociated ammonia as a nitriding agent. While it does not prevent absorption of nitrogen in high-speed steel in cyanide baths it considerably retards penetration.

A surface free from nickel will have a steely metallic luster after cleaning and will resist attack by 25% nitric acid. Those surfaces with nickel present have a dull gray appearance and are readily attacked in

NITRIDE BATH COMPOSITION

Constituent	Composition of	
	Fresh Bath	Aged Bath
Cyanogen (CN)	45-47%	25%
Cyanate (CNO)	1.1%	9-12%
Carbonate (CO_3)	1.9%	10-15%

EFFECT OF NITRIDING ON IZOD IMPACT*

Nitriding	Steel	Hardness Rockwell C	Izod ft. lb.
None	P	64.0	37
	M	65.3	36
10 min.	P	64.0	12
	M	64.9	12
30 min.	P	63.9	8
	M	64.1	9
1 hr.	P	63.9	7
	M	63.9	8
2 hr.	P	63.6	7
	M	63.9	8

*Data obtained in co-operation with J. G. Morrison, Landis Machine Company
Steel P—.70% C, 18-4-1 high-speed steel
Steel M—.80% C, 6-6-2 high-speed steel

NITRIDING EFFECT ON BEND TESTS

Treatment	Hardness, Rockwell "C"	Modulus of Rupture, psi.	Maximum Deflection, in.
1 min. 15 sec. at 2200 F.—Not Nitrided	65.1	624,000	0.123
2 min. 30 sec. at 2200 F.—Not Nitrided	65.4	576,000	0.108
1 min. 15 sec. at 2200 F.—Nitrided 10 min. at 1050 F.	64.8	366,000	0.066
1 min. 15 sec. at 2200 F.—Nitrided 30 min. at 1050 F.	64.6	330,000	0.061

Material—0.80% C, 6-6-2 high-speed steel

LIQUID NITRIDING INCREASES TOOL LIFE
(Continued)

10 to 20 min. by nitric acid which is commonly in 25% solutions.

When high-speed steel is immersed in an aged cyanide bath at nitriding temperatures, the steel surface catalyses the cyanate (CNO), which decomposes to furnish, among other things, nascent nitrogen and finely divided carbon. The nascent or atomic nitrogen at the surface of the steel combines to form quite stable nitrides and increases surface hardness. The finely divided carbon acts as inhibitor to nitriding and prevents an excessive amount of nitrogen from being supplied to steel surfaces.

Nitrogen content of the hardened and tempered high-speed steel will be highest at the surface and decrease rapidly towards the core. Turnings from nitrided annealed samples of tungsten high-speed steel can be analyzed and the nitrogen gradient estimated, as it is known that nitrogen pickup of an annealed steel is essentially the same as that of a hardened and tempered steel. At the usual nitriding temperature, the bulk of nitrogen is held in the first 0.0005 in. and practically all in the first 0.001 in. Nitrogen in the second and third 0.001 in. is somewhat above the normal nitrogen content of the steel.

Reasons for Aged Bath

Tools nitrided in fresh baths or for short cycles show steep nitrogen and hardness gradients, which are believed responsible for brittleness of case after such treatment. Longer immersion periods, higher temperatures or a thoroughly aged bath with more than 6% cyanate avoid these gradients. Lowering the gradient by reheating outside the bath causes loss of nitrogen. Reheating for 1 hr. at 1100 F. decreases nitrogen content of the case by one-third and about one-tenth of the nitrogen in the first 0.001 in.

No evident microstructural changes occur in nitriding, but a heavy concentration of nitrides at the surface gives a slaty appearance to the outer portion of the darkened zone. For "flash" cases (nitriding for 5 min. or less), case depth is barely discernible under the microscope. When nitrided for 30 min. at 1050 F., high-speed steel shows a microscopic case depth of 0.0012 in., and after 6 hr. at the same temperature a depth of 0.004 in. Actual penetration of the nitrogen and some improvement in hardness extends a slight distance below the microscopically measured cases.

Some carbon will be absorbed by high-speed steel at the lower temperatures used for nitriding (as compared to carburizing) but the amount should not be large. By analysis, 1.18% carbon was found in the first 0.001-in. layer from a sample of 0.705% carbon 18-4-1 high-speed steel which had been nitrided 30 min. at 1050 F. Most of this carbon adheres to the surface—embedded in minute microscopic pits—and it is likely that little has been absorbed by the steel. This microscopic pitting is not dangerous under normal circumstances, for the pits, located in the matrix adjacent to but not surrounding the carbides, are more shallow than grinding or machining marks.

Carburizing Detrimental

Nitriding of decarburized parts causes brittle surface conditions. However, nitriding may be used on partially decarburized tools and is definitely a corrective measure for surfaces that have been softened by grinding. The presence of highly carburized surfaces which, after heat-treatment, may contain a large quantity of residual austenite, appears to resist the penetration of nitrogen or at least prevents the formation of high surface hardness. Microindentation hardness tests on non-carburized nitrided high-speed steel samples gave hardness values between 1020 and 1150, while on samples previously carburized the values were 800 to 900.

None of the usual methods of hardness testing permit accurate evaluation of hardness of nitrided high-speed steel because of the shallow case. Rockwell "A" or "C" values show no change over that of treated but nitrided high-speed steels. Light loads may be used with superficial Rockwell, Monotron or Vickers hardness-testing machines but results are neither consistent nor accurate.

Some investigators have used special miniature Brinell tests or the microcharacter hardness test, but results were not too convincing. A Knoop indentor, with a light load, has been more satisfactory. Microindentation hardness tests have indicated that the maximum hardness at the surface of an 18-4-1 steel is obtained after nitriding at 1050 F. for approximately 3 hr., but that the change in hardness after 1 hr. is not great.

The nitrided case on high-speed tools makes them more brittle, but the function of the cutting tool is to remove metal, and rigidity rather than the usually conceived toughness is required if a tool is to function properly. Because of this, many nitrided tools give comparatively good performance even though the impact or toughness values are lower than those of tools which have not be nitrided.

Testing the brittleness of a nitrided case and interpretation of any results are extremely difficult. The simplest general test for edge brittleness is the scratching of window glass with a sharp nitrided tool edge. A brittle edge will dull quickly after an inch or two, while a properly nitrided part will scratch 10 to 15 in. and perhaps 60 in. before dulling. This practical test can be used to check the uniformity of tools coming from the nitriding bath.

Another method of evaluating the brittleness of high-speed steel is to conduct impact tests on unnotched test samples. The test is of such severity, however, that it yields no information on the ability of the steels to withstand the moderate small impacts normally encountered. It is of little value in checking the uniformity of a nitrided product because the normal scatter or variation of results is usually great.

Reduces Impact Strength

The 18-4-1 specimens listed in the tables for Izod impact tests were hardened for 1 min., 45 sec. at 2335 F. from salt-bath furnaces, quenched into a molten salt bath at 1200 F. for 45 sec. and air-cooled. The molybdenum high-speed steel specimens were similarly treated except that superheat treatment was for 2 min. at 2200 F. All specimens were then double tempered at 1050 F. for 1½ hr. and accurately ground to size. Specimens nitrided at 1050 F. were processed this way after grinding.

Bending tests indicated that nitriding lowers the modulus of rupture and the maximum deflection to about half of that obtained in non-nitrided specimens. It was obvious from the various tests that if the tools were already giving poor performance because of excessive impact, misalignment or other faulty mechanical conditions, nitriding would aggravate rather than assist operation.

TALKING SHOP

Customer Control

TEXTILE-MACHINERY PLANTS are in some ways the victims of their customers. If the customer wants one replacement part or one replacement loom, he won't be badgered into an improved type that is different from everything else. Result: One loom maker has 340,000 patterns (some 30 or more years old) in a storage building five stories high and a block long.

New models must literally be forced down complacent customers' throats. Profits are whittled out by close cost control (all jobs evaluated, almost all productive labor piecework, careful work scheduling.) New textile machines make extensive use of die castings, magnesium and aluminum alloys, plastics, pressed parts, and the like, as well as such processes as furnace-brazing and broaching. Some plants have rollover fixtures on conveyor lines; others move specialist gangs from unit to unit. In one case a 3-pass vertical surface broach produces a clip so rapidly that it can turn out in 8 weeks what formerly took three millers a year to do.

Seawater Plating

A LEADING Clydebank shipbuilder is electroplating fresh-water tank interiors with seawater. New tanks are filled with seawater and subjected to a 10-volt, 200-amp. current for 48 hr. through carbon electrodes. This deposits magnesium chloride as a tank lining, according to McGraw-Hill World News.

Replacement Policy

ONE textile-machinery plant will *investigate thoroughly* any proposed machine tool which can save 10% in direct labor and can be used 50% of the time, will *certainly buy at once* any tool which can save 20% in direct-labor and can be used 75% of the time. The rule holds even if the replaced machine is only 6 mo. old. Last year, purchases almost hit the half-million-dollar mark.

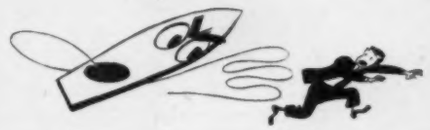
Safety Link

THE PICKER MOTION in a textile loom seems at first glance to offer a real opportunity for improvement. Result: Some 1400 improved motions have been patented in the last 150 years. But the most foolproof is still the cam-and-lever combination, with a good piece of hickory for the picker stick. In case of trouble, breakage is usually confined to the stick—which costs 17 cents. Other gadgets neglect this.

Machine (?) Age

TESTS in Japan and here show the abacus superior to the calculating machine, according to the newspapers, although a calculator did beat an abacus run by a Chinese laundryman in one Chicago test. Newspapers point the finger at our "mechanical age"—failing to consider that the abacus is 90% mental, the machine 100% mechanical, and that most of us can think faster than we can touch a button.

It is also reported that a Shanghai bank bought 27 calculators for its tellers some years ago. When the salesman checked back a year later, he found the tellers were conscientiously using the machines, then just as conscientiously confirming the results with their abacuses, according to *The New Yorker*. Just goes to show you how our minds cling to tradition—like checking a slide-rule calculation by longhand, jumping on a new platform, trying to shake any massive product, and staying out from under ladders.



Ignorance Is Bliss

IF A LOOM SHUTTLE goes berserk and flies up through the warp threads, the loom must be stopped instantly to avoid substantial loss of material. As loom speeds approach 300 picks per minute, stopping shock is tremendous. Major loom manufacturers are therefore using lighter materials for moving parts and studying shuttle and other motions with slow-motion cameras and stroboscopic lights. One camera, still under development, can take 1200 frames per second and is reasonably portable. One new strobo light gives so short and powerful a beam that still pictures can be taken with ordinary equipment. These have already shown a flying loop of thread as the shuttle starts that would have scared the pants off designers if they'd known about it 50 years ago.

Detroit Data

TWO INTERESTING recent developments from Detroit include a carbide slitting saw 0.006 in. thick and an inertia absorber for use with a flywheel on machine tools using milling or fly cutters. The latter gadget smooths out the shocks so a uniform cut is obtained despite variations in stock or cutter action.

Another Pi Poem

RECENTLY, we published an erudite verse for remembering the values of pi beyond the 3.1416 everybody learns. It elicited this simpler one giving 30 places beyond the decimal:

Sir—I send a rhyme excelling
3. 1 4 1 5 9
In sacred truth and rigid spelling.
2 5 5 3 5 8
Numerical sprites elucidate,
9 7 9
For me, the lesson's dull weight.
3 2 3 8 4 6
If Nature gain,
2 6 4
Not you complain,
3 3 8
Tho Dr. Johnson fulminate.
3 2 7 9

Train Machine Salesmen

BY GEORGE HABICHT, JR.,

Chicago metalworking plants will have the unusual experience of dealing with peddlers who know their stuff. Presenting a training course that offers ideas for dealers, users and builders

MACHINE-TOOL sales engineers worth their salt are consultants in good manufacturing methods. They know metalworking equipment and processes, and how to use them profitably. They know metalworking manfacturers in their district, what they make, how they make it. Furthermore, they have studied their market—and know how to sell it.

Such men don't "just happen." Most of them, including many of the key men in the Marshall & Huschart organization, learned their business by serving long apprenticeships. There was no plan by which promising young men could be developed.

Three junior machine-tool sales engineers started to call (initially with senior sales engineers) on customers for Marshall & Huschart the first of this year. They know their jobs. These men are not new to Marshall & Huschart. They started a year ago as apprentice sales engineers on a carefully prepared training program. Each was selected on the basis of personality, training in engineering subjects, shop experience, ability to speak and write well, and demonstrated ability to sell himself. The training program has added a thorough knowledge of the products he is to sell.

The 2,066-hr. course was recommended to the Veterans Administration for on-the-job training of sales engineers by the State of Illinois Board for Vocational Education. And it was so accepted under the provisions of the Servicemen's Readjustment Act of 1944 (G. I. Bill of Rights). From the start, we paid salaries much higher than usual training wages.

ORIENTATION PROGRAM—*24 Hours:* (1) Scope of training. (2) Business ethics. (3) History and progress of the machine-tool industry.

BORING MILLS—*Cylinder—27 Hours:* (1) General lecture. (2) Principles of operation and details of assembly. (3) Visit to factory. (4) Machine layout, assembly and operation. (5) Shop practices.

BORING MILLS—*Horizontal—50 Hours:* (1) General lecture and history of horizontal boring mills. (2) Principles of horizontal boring and use of carbide cutters. (3) Visits to plants where horizontal boring mills are in operation. (4) Operational usages. (5) Visit to factory. (6) Machine parts layout, functioning, unit and machine assembly. (7) Engineering data.

BORING MILLS—*Vertical—26 Hours:* (1) Lecture on theory of vertical boring mills. (2) Assembly and engineering details. (3) Visits to two factories. (4) Application of machines to various types of work and safe operation. (5) Manufacture of parts, and parts assembly into vertical boring mills.

BROACHING MACHINES—*45 Hours:* (1) Lecture on theory of broaching. (2) Review of basic hydraulics and application to machine tools. (3) Methods of broaching—internal and external. (4) Visit to factory. (5) Machine setups, operation and assembly methods. (6) Visual study of films.

DRILLING MACHINES—*General—8 Hours:* (1) Lecture on history of drilling. (2) Division of operations. (3) Gages and inspection. (4) Use of jigs and fixtures. (5) Speeds and feeds. (6) Machine types and costs.

DRILLING MACHINES—*Gang—20 Hours:* (1) Analysis of work for gang drills. (2) High-production tooling. (3) Visits to three factories. (4) Machine assembly, layout and operation.

DRILLING MACHINES—*Heavy Duty—15 Hours:* (1) Method of counterboring and countersinking. (2) Visit to factory.

DRILLING MACHINES—*Multiple Adjustable—17 Hours:* (1) Study of universal-joint and spiral-drive drillers. (2) Work applications. (3) Visits to two factories. (4) Parts assembly.

DRILLING MACHINES—*Fixed Center—5 Hours:* (1) Limited uses. (2) Visit to factory.

DRILLING MACHINES—*Radial—35 Hours:* (1) Types of radial drills and various drilling procedures. (2) Accessories and their use. (3) Visit to factory. (4) Statistics and specifications.

DRILLING MACHINES — *Sensitive — 21 Hours:*(1) Uses. (2) Location procedure. (3) Visit to factory.

DRILLING MACHINES—*Upright—29 Hours:* (1) Comparative analysis with radial drills. (2) Standard drilling on uprights, and operator technique. (3) Visits to two factories.

DRILLING MACHINES—*Way—11 Hours:* (1) Principles of way drilling. (2) Jobs to which applicable. (3) Visit to factory.

DUPLICATOR—*17 Hours:* (1) Duplicator method of production. (2) Die and mold applications and varieties of work possible. (3) Visit to factory. (4) Technique of sub-assembly and machine assembly. (5) Setup and operation of machines. (6) Matching cutters and stylus. (7) Visual study of film, "Exact Duplicate."

FILING MACHINES—*8 Hours:* (1) Principles and use in diemaking. (2) Visits to two factories. (3) Machine assembly and layout. (4) setup and operation.

GEAR MACHINERY—*Disk Cutter Type—25 Hours:* (1) Review of gearing problems. (2) Principles of forming gear teeth, including cutter use. (3) Uses of disk cutter for spur gears, bevel gears and rack gears. (4) Visit to factory. (5) Setup practice and machine operation. (6) Assembly methods.

GEAR MACHINERY—*Hobbing Machines—25 Hours:* (1) Generating the involute curve. (2) Hob selection. (3) Visit to factory. (4) Hobbing of spur gears, helical gears, worms and worm wheels. (5) Machine layout and assembly. (6) Advanced gearing problems.

GRINDING MACHINES—*General—24 Hours:* (1) Study of the application of grinding as a machining method. (2) Lecture on the principles of grinding, including the selection of grinding wheels, and the various bonding materials. (3) Study of the accuracy obtainable and methods of gaging and inspection. (4) Review of the types and sizes of grinding machines and their costs. (5) Setup and operation.

GRINDING MACHINES—*Bench and Pedestal—16 Hours:* (1) Visit to factory.

GRINDING MACHINES—*Contour—4 Hours:* (1) Grinding cams and special contours.

GRINDING MACHINES — *Cylindrical — 40 Hours:* (1) Study of the methods of grinding cylindrical surfaces. (2) Various centers and workholders. (3) Visit to factory.

GRINDING MACHINES—*Drill and Tap—7 Hours:* (1) Study of various workholders. (2) Understanding of the "theoretically perfect drill point," and the cost and advantages of good drill grinding. (3) Visit to factory.

GRINDING MACHINES—*Face—20 Hours:* (1) Ability to figure fast stock removal. (2) Understanding the comparison with surface grinders. (3) Visit to factory.

GRINDING MACHINES—*Internal—68 Hours:* (1) Study of the problems of chucking grinds. (2) Visit to factory. (3) Setup and operation.

GRINDING MACHINES—*Oscillating and Radius—20 Hours:* (1) Understanding the application of these grinders to the grinding of ball-bearing races. (2) Visit to factory.

GRINDING MACHINES — *Surface— 140 Hours:* (1) Lecture on the work application various types of surface grinders and finishers, and accuracy obtainable. (2) Study of the methods of holding work. (3) Knowledge of dust collection. (4) Visits to three factories.

GRINDING MACHINES—*Tool and Cutter—42 Hours:* (1) Lecture on and study of the correct methods of grinding and holding tools and cutters, including carbide-tipped tools. (2) Understanding the comparative costs of various types of tool and cutter grinders. (3) Visits to two factories.

GRINDING MACHINES—*Saw —9 Hours:* (1) Lecture and study of saw grinding techniques. (2) Visit to factory.

HAMMER—*24 Hours:* (1) Study of the following types of hammers: board drop, steam drop, steam forging, pneumatic, cecostamp, special applications of hammers and presses. (2) Ob-

to Know What They're Talking About

PRESIDENT, MARSHALL & HUSCHART MACHINERY COMPANY

Though of the on-the-job type, this training program was not one in which production operations competed with training work for students' attention. Fully 90% of the time spent on the course was nonproductive, as far as immediate benefit was concerned.

Basically, the course included approximately 24 hr. of instruction in the scope of the training program, business ethics, and the history of the machine-tool industry; 1,562 hr. of study of machine-tool literature, lectures on the features and applications of specific types of machine tools, visits to users' plants, and visits to plants of makers of equipment; 120 hr. of scheduled work in the "Quotations and Proposals" division; 80 hr. of scheduled work in the engineering division, studying the installation and servicing of machine tools, and the selection and use of accessories and attachments—including a number of field trips with factory service engineers; and 280 hr. of scheduled apprentice selling. It was supplemented by required technical reading, including reprints of material published in *American Machinist*, and by attendance at A.S.M.E. seminars.

An important part of the course was a weekly discussion with a company executive of the material studied during the preceding week. This made it possible to measure the progress made by each student, and to judge the effectiveness of the program. These meetings were not formal. They drew out each student.

Progress made by each of the three students during their year of training has convinced us that the expense involved has been justified. The same course will be used again when more men must be added to the sales staff, changed slightly only to meet changing selling practices or market conditions.

Today there are several veterans working in Marshall & Huschart's main office who are taking a preliminary learn-while-working sales training course. They are high-school graduates and, depending on their personal needs and characteristics, they are taking from two to four years of night-school work in both academic and technical subjects. These students are urged to take part in all student activities, in order to improve their ability to know and work with others. In the office, they are assigned to clerical jobs for which past experience fits them. As they progress, and as new sales engineers are needed in the field, men from this group will be moved along into the advanced sales training course.

tain understanding of the characteristics of materials and their adaptation to forging. (3) Knowledge of developments in modern drop forging and their relation to current machine-shop practice. (4) Sheet-metal work and forge-shop practice. (5) Visit to factory.

HONING MACHINES—*9 Hours:* (1) Principles of honing. (2) Expanding hones and selection of stones. (3) Visit to factory. (4) Study honing techniques and applications.

JIG BORING MACHINES—*20 Hours:* (1) Theory of jig boring and accuracies obtainable. (2) Visit to factory for study of machine assembly, setup and operation.

KEYSEATING MACHINES—*4 Hours:* (1) Use of keys and kekyways, and types of cutting tools used. (2) Comparative analysis of keyseating and broachig. (3) Visit to factory.

LAPPING MACHINES—*17 Hours:* (1) Lapping procedures and compounds. (2) Visit factory.

LATHES—*Automatic Vertical—50 Hours* (1) Principles of multi-station machining. (2) Division of operations. (3) Tooling and chucks for high production. (4) Visit to factory. (5) Understanding of reversing problems encountered.

LATHES—*Vertical Turret—20 Hours:* (1) Knowledge of types of work applicable to vertical turret lathes. (2) Methods of loading and holding heavy work. (3) Cutting tools, feeds and speeds. (4) Visit to factory. (5) Setups and operation.

LATHES—*Turret—50 Hours:* (1) Adaptability for multiple operations. (2) Knowledge of type of tools used on turrets. (3) Proper sequence of operations. (4) Best setups for production jobs. (5) Visit to factory. (6) Review.

LATHES—*Horizontal—50 Hours:* (1) General lecture on lathe work. (2) Study the uses of the following types of lathes: engine lathes, manufacturing lathes, toolroom lathes, (3) Theory of single-point turning. (4) Speeds vs. feeds.

LATHES—*High-Production Automatic Horizontal—34 Hours:* (1) Principles of multiple tooling. (2) Division of cuts for best machine use. (3) Knowledge of job application with proper holding fixtures and tooling. (4) Visit to factory. (5) Construction and setups.

LATHES—*Bench Precision—16 Hours:* (1) Features for precision work. (2) Visit to factory.

MILLING MACHINES—*General—16 Hours:* (1) Lecture on history of milling procedure. (2) Study of theory and use of milling cutters, and types of milling cutters. (3) Application of carbide and special alloy tools. (4) Study of speeds and feeds in relation to work materials. (5) Study, through plant visit, machine assembly, setup procedure, operational procedure and applicatory measures.

MILLING MACHINES—*Bed Type—10 Hours:* (1) Production advantages. (2) Mounting tools. (3) Work-holding methods. (4) Visit to factory.

MILLING MACHINES—*Contour and Cam—10 Hours:* (1) Theory of contour milling. (2) Cam layout, design and application. (3) Visit to factory.

MILLING MACHINES—*Hand— 10 Hours:* (1) Uses of hand mills and precision obtainable. (2) Visit to factory.

MILLING MACHINES—*Plain, Knee-Type—8 Hours* (1) Theory of plain milling. (2) Visits to two factories.

MILLING MACHINES—*Planer Type— 27 Hours:* (1) Uses of planer-type milling machines. (2) Work capacities and setup procedure. (3) Use of jigs and fixtures. (4) Combination of boring and milling operations in one setup. (5) Visits to two factories.

MILLING MACHINES—*Thread —35 Hours:* (1) Theory of threads and approved standards. (2) Methods of milling threads. (3) Types of cutters and their application. (4) Visit to factory.

MILLING MACHINES—*Vertical—17 Hours:* (1) Application of vertical-spindle milling machines. (2) Uses of duplicationg attachments. (3) Visits to three factories.

PANTOGRAPH MACHINES—*8 Hours:* (1) Theory of the pantograph. (2) Applications in engraving and etching from master copy. (3) Two-dimensional and three-dimensional engraving. (4) Visit to factory to study machine assembly, setup and operation.

PLANERS—*45 Hours:* (1) Treatise on planers, showing the use of singlepoint and form tools on reciprocating work. (2) Workholding methods. (3) Use of hydraulic and mechanical drives, (4) Production advantages. (5) Visit to factory.

PRESSES—*119 Hours:* (1) Study the application of the following types of presses to various types of work: forging, horning and wiring, hydraulic, inclinable, notching, straight-side, and trimming. (2) Knowledge of proper die design. (3) Proper sequencing of operations for best production. (4) Visits to three factories (5) Observation of construction details and methods of operation. (6) Driving methods

SAWS— *27 Hours:* (1) Study methods of sawing stock. (2) Knowledge of blade designs and their limitations. (3) The application of power hacksaws and cold saws. (4) Visits to three factories (5) Observe construction details and special applications.

SCREW MACHINES—*General—8 Hours:* (1) Lecture and study of screw machines and their use in production. (2) Types and applications. (3) Assembly, setup and operation.

SCREW MACHINES—*Hand—38 Hours* (1) Sequence of operations. (2) Production capabalities. (3) Visit to factory.

SCREW MACHINES—*Automatic—13 Hours:* (1) Review of cam layout and design. (2) Production and accuracy obtainable. (3) Methods of gaging and inspection. (4) Study of Swiss-type screw machines. (5) Visit to factory.

SHAPERS—*52 Hours:* (1) Study the application of the following types of shapers to their respective fields of work: tool-room, vertical, (2) Knowledge of the theory of reciprocating-tool machines. (3) Proper methods of holding work. (4) Know the types of shaper drives and their application. (5) Visits to three factories. (6) Observe construction details of the machines.

SURFACE PLATES—*20 Hours:* (1) Theory of laying out work on a production basis. (2) Understand the use of surface plates to cut down "idle time" on the machines. (3) Degree of accuracy required. (4) Visit to factory.

THREADING MACHINES — *General— 4 Hours:* (1) Uses of threading machines. (2) Study of assembly, operation and setup.

THREADING MACHINES—*Roller—8 Hours:* (1) Use and types of tools and methods of rolling threads. (2) Visit to factory.

THREADING MACHINES—*Pipe and Bolt—8 Hours:* (1) Use of threading dies. (2) Mobility and productivity of pipe and bolt threaders. (3) Visit to factory.

QUOTATIONS AND PROPOSALS — *120 Hours:* (1) General procedures involved. (2) Familiarization with price lists. (3) Cost control accounting, credit, and preparation of records. (4) Problems, and actual proposals.

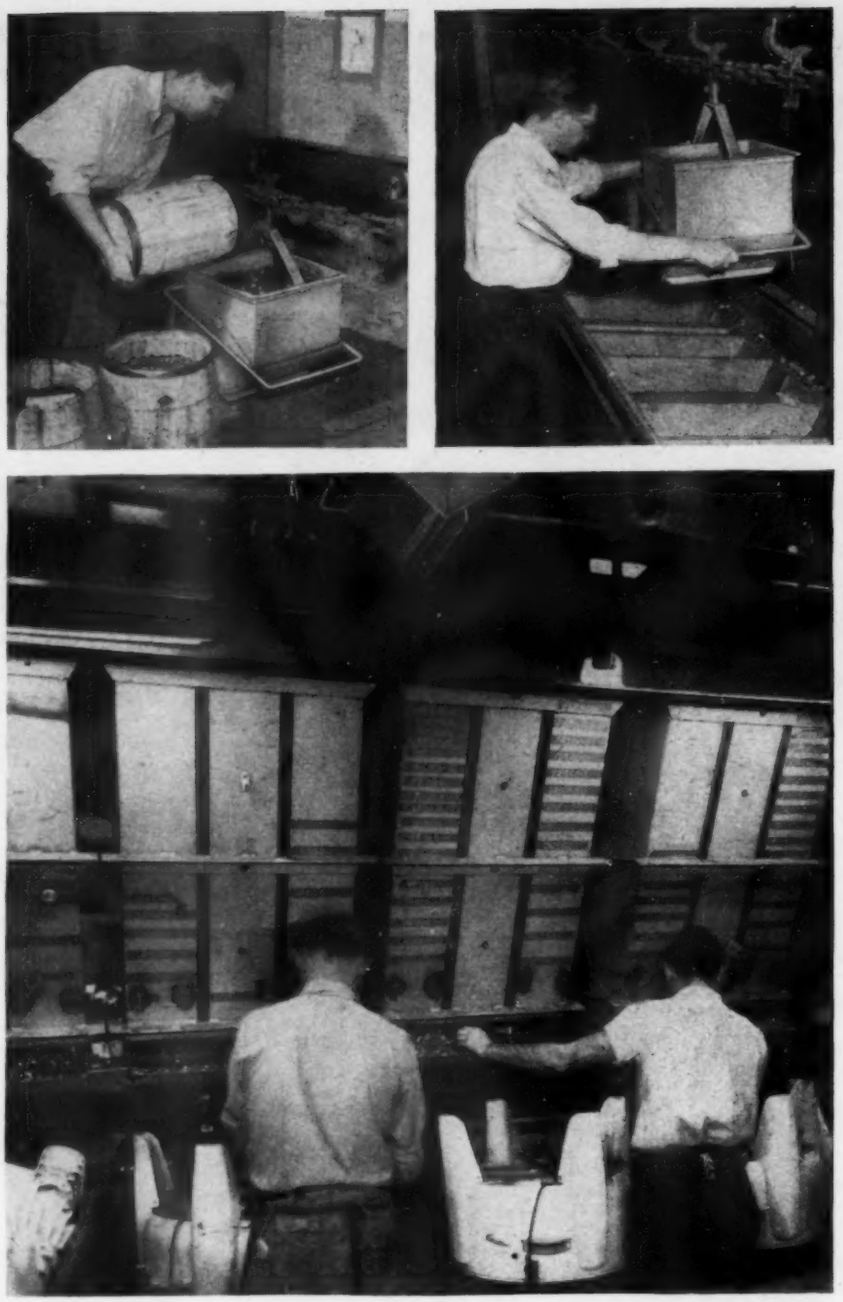
ENGINEERING DATA—*80 Hours:* (1) Servicing machines. (2) Safe operation of machine. (3) Machine foundations and installation. (4) Coolants. (5) Accessories and attachments.

APPRENTICE SELLING—*280 Hours:* (1) Familiarization with territories.. (2) Accompanying senior salesmen on actual calls.

Conveyor Hoppers

SUPPLY ASSEMBLY HARDWARE

BY KENNETH F. BROOKS
MASTER MECHANIC
NINETEEN HUNDRED CORPORATION



Fastening hardware is dumped from keg to hopper, moves on a 2000-ft. conveyor above assembly areas, and is dumped into gravity bins (large photo) at assembly points. Tag color shows proper area, a written number shows proper bin. Conveyor is stopped for loading (upper left) and unloading (upper right)

GEARED to a production of almost 2,000 domestic washing machines and a large number of ironers each 8-hr. shift, our final-assembly line needs thousands of screws, bolts, nuts, lockwashers and other hardware items every day. Final assembly does not have space to pass industrial trucks, except around the perimeter, so we deliver hardware items in 15-in. square by 16-in. deep dump-bottom hoppers suspended from a power-driven overhead monorail chain conveyor.

The 100 dump-bottom hoppers on the 2,000-ft. long conveyor are spaced 20 ft. apart, and the conveyor makes a complete circuit in 100 min. Hoppers are loaded directly from kegs and cartons in the receiving department. The top of each hopper at the loading station is only 22 in. above the floor (top left), which makes it possible for one man to lift and dump a partially filled keg, or for two men to lift a full keg. Each hopper holds about 4½ kegs. The conveyor is stopped while hoppers are loaded.

Loading soon will be simplified, as we now are installing a set of storage bins in the warehouse which will be arranged for chute delivery to hoppers. This welded-steel bin unit will make it possible for one man to load hoppers with considerably less effort.

When a hopper is filled, the materials handler in the receiving room hangs on a colored tag (yellow, green, red or blue) which indicates the assembly area to which the parts are to be delivered. The tag also carries the part number, so the materials handler in assembly will know into which bin to dump the hopper.

Tray-bottom bins hold hardware items above the main assembly conveyors (large photo). The hardware conveyor carries the hopper loads of hardware above the bin top where there is also a catwalk (upper right). Along each row of hoppers, directly in front of the catwalk and within easy reach is a control rod, with one end connected to a switch which stops or starts the conveyor to spot a hopper for dumping. Hoppers have quick-opening bottoms.

For inventory, and to permit assembly supervisors to watch stocks of needed hardware parts, a strip of glass is set vertically in one wall of each bin. Strips of adhesive tape marked with quantity values are applied alongside the glass strip so a quick check can be made. Adhesive tape was used for this because strips can be changed readily when changes in models assembled requires changing the part stored. These bins frequently are used also to hold stock parts such as mounting brackets, hose clamps, etc.

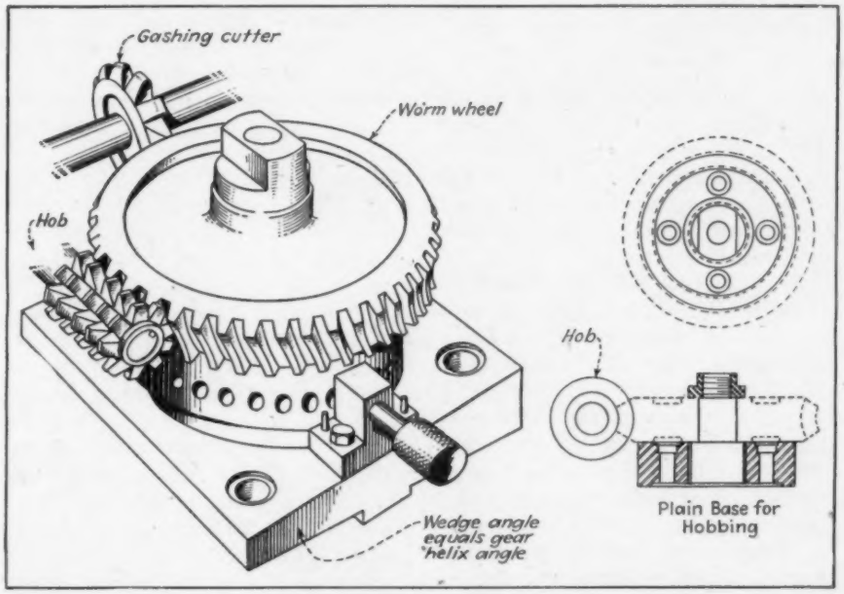
Practical Ideas

Worm Wheel Milling Without Centers

CHARLES W. METTER
Princeton, N. J.

This hobbing fixture was designed for hobbing a large number of worm wheels in a small shop. When hobbing is done on a milling machine between centers, the setup is not very rigid, especially when the worm wheels are large in size, and the cuts must be rather light. This increases production time. This fixture puts the thrust of the cut directly on the table, and due to its simple construction, it is very rigid, allowing heavier cuts and higher speeds without chatter. Use of this fixture was found to reduce production time by 75%. By setting the stops on the table of the milling machine, it is possible to cut the worm wheels to size without stopping to measure except as a check.

By looking at the drawings of the hobbing fixture it is easy to see how little time it would take to make the fixture. The base, pivot, and cap are made of machine steel. The bushing is made of bronze. The worm wheels were approximately 10 in. in diameter and approximately 2¼ in. wide. From these sizes, the general proportions of the fixture parts can be estimated as the drawings are to scale. The base was faced, bored, and turned on a lathe taking care to keep the opposite faces parallel. The holes for the four T-head bolts were counterbored to seat the nuts below the top surface of the fixture. The cap, after being turned and threaded, was milled on two opposite sides to fit a 2-in. open end wrench. The cap locks the worm wheels to the pivot and these parts revolve as a unit.



Worm wheel production has been quadrupled by providing flat base fixtures that allow heavy cuts without bending

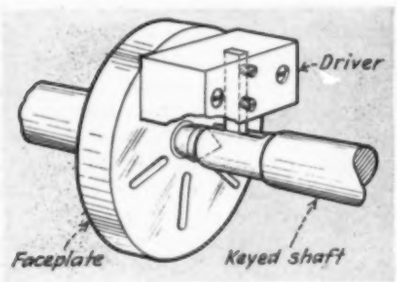
The fit between the base and the bushing was tight, and the bushing was pressed in place with an arbor press. The fit between the pivot and the bushing was snug preventing shake between the parts. In setting up the fixture, the height of the milling machine table was adjusted so the hob is in the center between the faces of the worm wheels.

The gashing fixture was designed for the same reason as the hobbing fixture, that is, to put the thrust of the cut directly on the table giving a more rigid setup than between index centers. In using this fixture, it is best to set the stops on the milling machine table and gash the worm wheels to within 0.015 in. of the total depth.

As in the case of the other fixture, this also takes very little time to make. Everything except the hardened steel indexing pin is made of machine steel. The base was first turned on a lathe and then the lead angle of the worm wheel was cut on the bottom on a shaper making an angle, 3½° in this case, between the top and bottom surfaces of the base. The longitudinal guide, also cut at the same time on the shaper, lines up the fixture by fitting in the slots on the milling machine. The indexing base was faced, bored, and turned on a lathe and then the holes for the indexing pin were drilled on the circumference with index centers on a milling machine. The number of holes equals the number of teeth on the worm wheels, which was 40 on this job. The index-pin should go into the holes about 1 in. and the holes should be drilled about 1¼ in. deep. The fit between the indexing base and the base itself should be close enough to eliminate shake. In order to assemble these two parts it was necessary to drill a hole, not shown on the drawing, about ¼ in. diameter through the indexing base to allow the air to escape from between these two parts. Without this hole it would be almost impossible to take the fixture apart. The arbor in this fixture is pinned to the indexing base with a taper pin.

A key is fastened in a key slot on the arbor and fits into the keyway in the hub of the worm wheels. Tightening the cap securely locks the worm wheel to the indexing base, and these parts revolve as a unit. The block that holds the indexing pin is bolted and pinned to the base with two capscrews and two taper pins.

The hardened-steel pin has a slight taper on its leading end to allow it to enter the holes easily. The fit between the indexing pin and the 40 holes must be close enough to eliminate shake. The holes for the four hold-down bolts were positioned to fit the milling machine table on which the fixture is to be used. These holes must be counterbored to take care of the angular top of the base. Finally, in order to cut down heat and wear on the cutter it was found advisable to block index. This was accomplished by cutting every 13th tooth around the worm wheel which meant that each tooth being cut was approximately 120° around the worm wheel from the previously cut tooth. This procedure gave the heat of cutting time to dissipate uniformly.



Faceplate-mounted driver-key eliminates lathe dogs

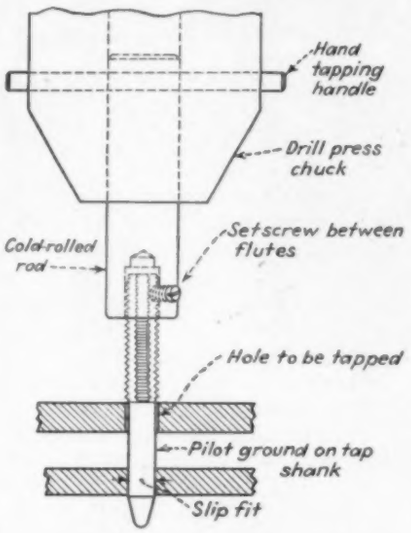
Permanent Faceplate "Dog" Simplifies Shaft Turning

J. H. QUATKEMEYER
Norwood, Ohio

One of the problems of turning radii and of chasing threads on shafts in production is that of driving the work.

By milling one of the end key slots early in the process, all subsequent operations can be set up quickly, eliminating standard lathe dogs and greatly speeding the whole job.

The driver is a U-shaped block bolted to the faceplate with two screws. The slot is made the width of the widest key slot and the block is mounted far enough off center to clear the largest shaft. Smaller shafts and smaller key slots are driven with longer and narrower keys. But to turn any batch of work on centers, it is necessary to make only one setup, and the pieces can be inserted and removed with the minimum of delay.



Reversed tap with ground-down shank provides a pilot for starting a tap squarely or following another hole

Piloted Tap Aids Line Tapping

ROGER ISETTS
Kenosha, Wisconsin

Many times around the shop and in the tool room it becomes necessary to tap a hole accurately in line with another drilled or reamed hole. This can be accomplished easily with a standard tap and a piece of round cold-rolled stock.

First, a pilot is ground to a slip fit on the opposite end of the tap to the desired diameter of the drilled or reamed hole. (The shank of the tap is ground down to this diameter.) A taper is also ground where the thread begins so the tap may easily "find" the hole. Then, the piece of cold-rolled is tapped in one end to receive the tap head first. When this is done, a smaller hole is cross-tapped for a setscrew which holds the tap in place between the flutes, preventing it from backing out on the return stroke. The holder can then either be inserted in the chuck of a drill press or be equipped with a handle if the job calls for hand tapping.

The entire holder is simple and cheap to make and has proved itself extremely accurate, eliminating the necessity of purchasing high-cost, special taps.

Wire Loop and Proper Oil Improves Steadyrests

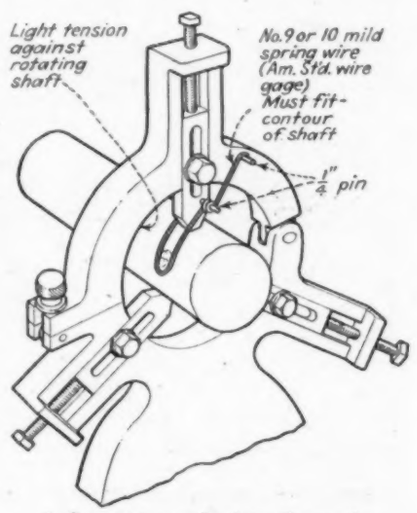
E. D. CLARK
San Jose, Calif.

First, to assure good, score-free results when using a steadyrest, it is important to use the right lubricant. I use regular automobile differential grease with some graphite added, and thin it with machine oil until it flows slightly at room temperature.

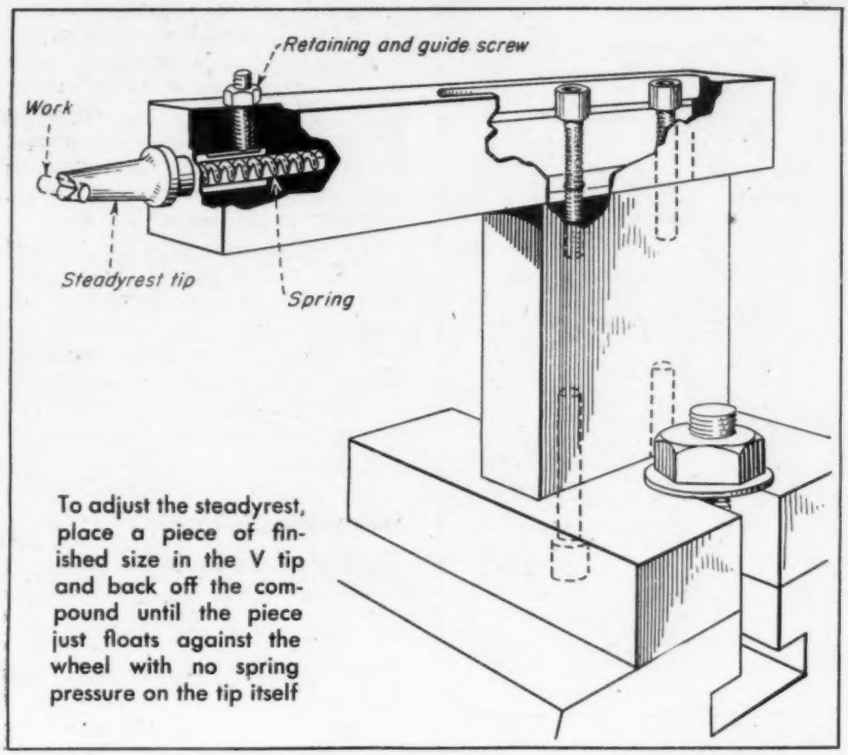
Next, it is necessary to keep the lubricant confined to the bearing surface and return it after the steadyrest fingers squeeze it out at the sides. For this job, I bent a piece of spring wire into a loop and mounted it on pins so the wire pressed against the work. This loop has to be bent a little for each job that comes along so it will conform closely to the surface of the piece and scrape up the grease.

When everything is operating properly, a roll of grease forms at the lower end of the loop, allowing a steady thin line to escape while it is picking up the same amount as it comes around.

I recently completed 550 12-ft., 6½-in. diameter shafts without a single one scored due to a dry rest.



A finger spreads the oil evenly



To adjust the steadyrest, place a piece of finished size in the V tip and back off the compound until the piece just floats against the wheel with no spring pressure on the tip itself

Special Steadyrest Holds Small Cylindrical Work

ALLAN D. NIXON
Springfield, Mass.

We had a lot of 150 die punches 6 in. long, 2 in. of which were ground to 0.250 + .000 — .002 in. and 4 in. ground to 0.131 + .009 — .000 in. It was practically impossible to keep the taper out of this work until I made up the fixture described. I understand that ordinarily these would be ground on a centerless grinder, but with a small lot to produce in a small shop that's out of the question and yet we didn't want to farm the job out, for that, too, would have been expensive.

In use, the bar, which holds the tip, which in turn, contacts the work is adjustable on the riser. The whole fixture is attached to the "T" slot on the swivel table of the grinder. We found in use that the adjustment should be made so that when the work was finished there would be no spring tension of the tip against the work and no play. In this way, when first starting, the work would grind small in the center until it was down to size when, there being no spring tension the work would straighten out,—and you have a perfect job.

The socket screw and set nut serve no purpose other than to fit in the milled slot in the tip to keep it from falling out when changing work. I made a 60° Vee in the tip where it contacts the work, as our work was so small but this could be made 45° if desired. I am making an assortment of interchangeable tips to accommodate work from 0.125 to 0.375-in. diameter as we find it cuts the time on long slender work up to 35%.

The lengths of the bar (one in the sketch) and the riser too would vary so that the tip would exactly center the work and be the right length to reach from the T slot on different machines to the work.

Portable Coolant System Serves Many Machines

GEORGE TAYLOR
Oak Ridge, Tenn.

The popularity of tungsten-carbide tipped tools has resulted in much lathe machining being done without coolants. Yet, certain types of work occasionally require the use of coolants.

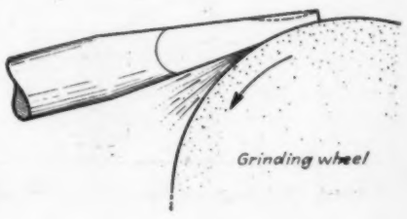
After periods of idleness coolant systems may not function at the twist of a valve. Soluble oil mixtures may turn rancid and the whole system must be cleaned and refilled. Some machines have a troublesome pump hooked to the main drive which is engaged by slipping on a belt. Units of this type usually require careful priming to start them circulating. Lines have a way of collecting chips and dirt which lodges in vital points.

An ideal arrangement when intermittent use of coolants on several machines is needed is a tank of coolant which is mounted on casters and can be used with any lathe requiring coolant. The tank and self-priming electric pump was obtained from a new model lathe. The addition of hose and casters was the only change made. It might be necessary to cut the top down a little in order for the tank to roll under the drain of the chip pan of any lathe in the shop. An electrical outlet was added along the side of the starting and motor control box on each frame. With the addition of a hose connection to the coolant spill pipe, the installation was complete.

The initial unit worked out so well that several were built. Each one now contains a different coolant. If a job needs sulfurized cutting oil, a tank is rolled under the chip pan of the lathe. The operator connects the hose and plugs in the cord and coolant starts flowing. The tanks are in use often enough to end the problem of contamination. Also, the older machines have a dependable source of coolant available where formerly there was none or a doubtful sputtering supply at best.

Screwdriver Improvement — About the simplest and quickest way to get rid of the senseless and detrimental taper on screwdriver blades (which tends to lift the blade out of the screw-head slot) is to hold the blades flat against a wheel producing two smoothly concave faces with the ends of the arc parallel or just a little way past the thinnest point.

Of course, the side taper should be ground off also as it prevents the bit from bottoming. *Charles E. Krause, Reading, Pa.*



Swinging Arm Slots Screwheads In Drillpress

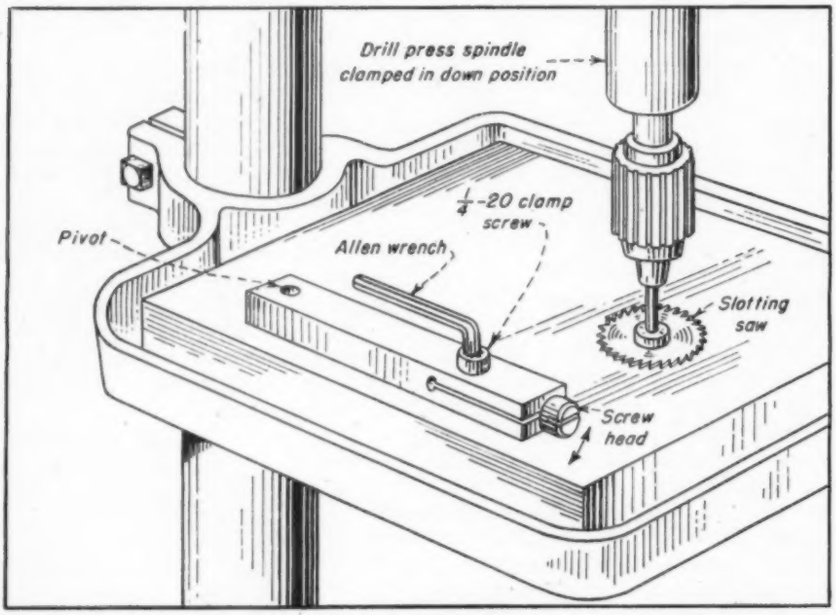
L. A. H. CASPER
Ladysmith, B. C., Canada

Screws to be slotted are loaded in the end of a ½-in. square bar drilled to receive them, slotted and provided with a ¼-in. clampscrew. The bar pivots about a pin in the other end which is pressed into a hole in the table.

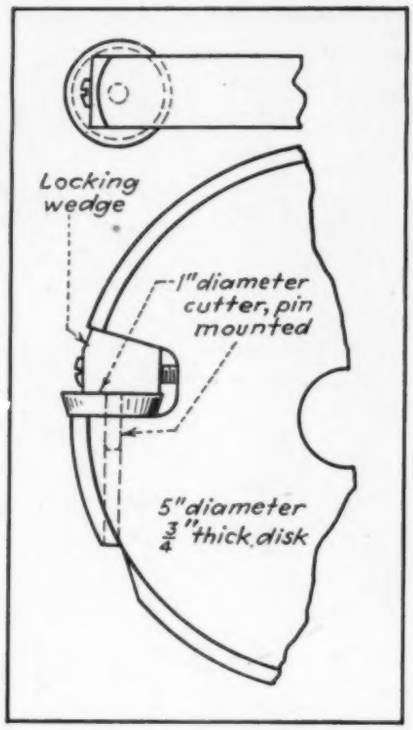
Chuck the slotting cutter and bring the spindle down and clamp it so the cutting plane hits the center of the screwhead. Next, adjust the table so the arm will bring the seated screws across the cutter at the correct depth.

Loading of the screws is done with the right hand and clamping and feeding with the left. Depending on individual preferences and right or left hand relative dexterity, and upon whether or not the drill spindle is reversible, the components can be arranged in many positions. In planning the setup, though, remember this work should be fed against the cutter rotation and not with it. Naturally, too, loading behind the spindle is not as convenient or as safe as front loading, and for long runs a guard should be installed over the cutter in any case.

Simplicity and low cost in both time and material are evident in this device, and the drillpress need not even be tied up for the whole setup can be removed quickly.



Pinned to swing on the drill press table, this arm holds screwblanks securely



Pin-mounted circular inset blades can be rotated as they become dull

Inset-Disk Cutters Give Long Tool Wear

PETER RIGGIO
New York, N. Y.

We have made built-up milling cutters in several sizes and with varying numbers of teeth by setting circular disks into the periphery of the cutter blank. The notch in the blank is tapered so, with the cutter in place on its pin, a wedge can be screwed in, locking the cutter in position. In this case, the cutters are set radially, that is with zero rake angle, but there is no reason why any angle can not be set.

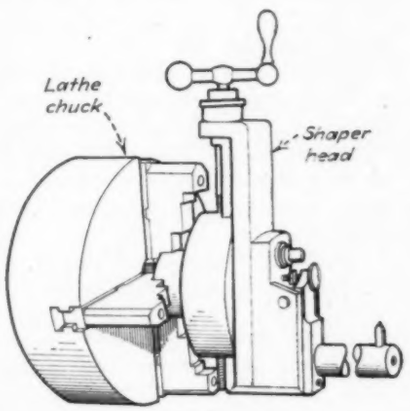
The big advantage of this type of cutter is that it permits rotation of each blade as wear occurs so the complete cutter can operate for much longer periods between grinds. Carbide or carbide-tipped cutter disks would improve the tool still further by permitting higher speeds and feeds.

Shaper Head In Lathe Chuck Permits Boring

U. WHEATLEY
Penshurst, N. S. W., Australia

I had to chase a thread in a large forging. The work was too large to swing on any of our lathes and the hole was too big to tap. The problem was solved by borrowing the head from our shaper, chucking it in the 4-jaw chuck, and locking the clapper in place with a boring bar replacing the toolpost. The micrometer dial permitted accurate feed settings for every cut and made it possible to back off the tool at the end of each cut for rapid returning and resetting.

With a simliar setup, but using a straight, axial-projecting tool, I have faced small areas on large castings with equal success. With the work bolted to the cross slide you can position it quickly to face, bore or, counterbore or thread several holes on the same piece.



Radially adjustable tool in lathe chuck cuts threads in heavy castings

On slow cutting, the tool infeed can be accomplished by hand as the knob comes around each time, or an automatic feed can be arranged by substituting a star wheel for the knob so a finger will trip the feed one tooth each revolution.

Bent Screw Checking Methods

NORVAL MARTIN
Glendale, Calif.

I noted in a recent issue of *American Machinist* a suggestion for straightening a screw involving a very accurate nut and then indicating on the nut for run-out. There are many ways to do this job more accurately and what is more important, do it with standard or at least quickly fabricated fixtures.*

The simplest and most universal is to mount the indicator in the lathe toolpost, set the gearing to the thread being straightened, close the split-nut, and measure run-out directly on the pitch diameter of the screw with a suitable ball or cone point on the indicator. Of course the screw must be dogged to the spindle so that it revolves on centers, or it may be colleted if no centers are available.

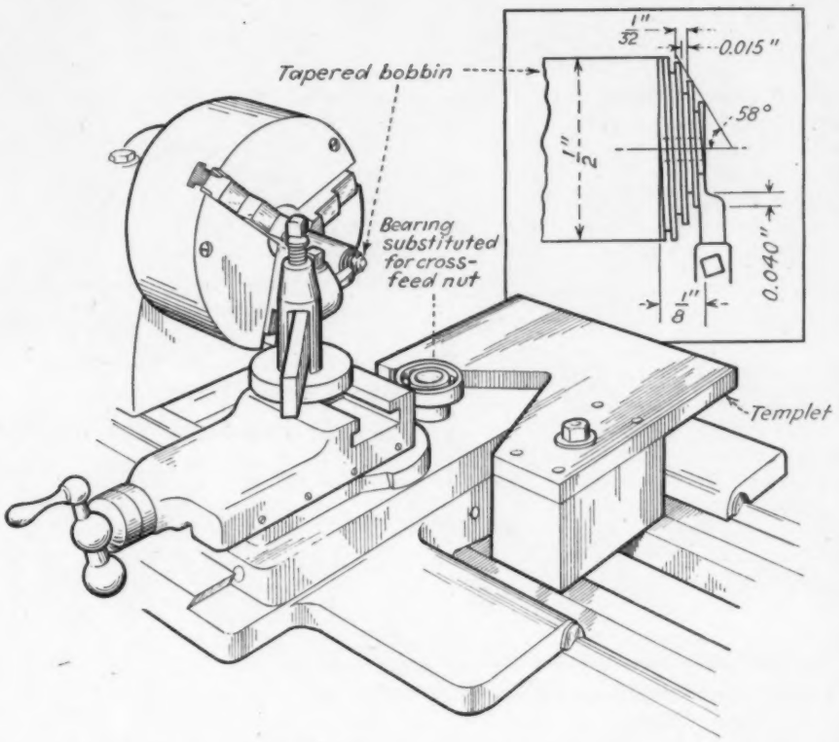
Another direct and equally positive way is to support the screw in V-blocks made of thin stock so that the V engages the thread. An indicator mounted on surface gage may then take reading directly from screw as the sharp "V" will act as a nut and make the screw advance as it is rotated.

A little more refined method may be performed on the surface plate by supporting the screw on correct wires and hunting the "low" reading with a spherical point of correct diameter. This is tedious but very flexible in application.

Of course the optical comparator affords the best way of checking a bent thread, but the shop that can boast an optical comparator usually doesn't have bent screws.

An internal thread may be chucked accurately by setting the lathe to correct lead and indicating directly on the thread as though indicator point were a threading tool.

* *The reason for the accurate nut was to provide a surface upon which to apply straightening pressure. Editor's note.*



Unusual profiles of many kinds can be duplicated on a standard screw-cutting lathe by substituting a bearing and templet for the cross slide feed nut

Templet Guides Tapered Helix Cutting Tool

NORMAN BRACKETT
Rochelle Park, N. J.

We had to make some tapered bobbins which were used to control the predetermined variable speed of an arm.

It would have been impossible to make a form tool for this operation because of the helical groove, and not having the automatic machines to do this job, we adapted a bench lathe. The first step was to remove the feed nut from the cross slide of the lathe, and in its place we put a shaft turned to a close fit. The other end was turned to a press fit on an old bearing we had. (Size meant nothing as long as it would run freely.) The longitudinal feed was short so the templet didn't require much length. It was shaped to reach around across the slide to rest on top of a block bolted over the inner ways. This block allowed only enough room to shift the carriage clear of the work.

The bobbin was first turned to the correct taper on another machine, then rechucked on this machine. An indicator was held in the toolpost and the carriage was then run back and forth against the straight edge portion of the templet. By moving the carriage back and forth, the cross slide would move in and out at the templet angle and by tapping, we were able to get the same angle as we had turned on the bobbin.

The lathe was then set to cut a 32-pitch thread. A wide flat tool was used first to form the flat section at the top of each groove. Then a tool formed to the groove width cut the groove to depth in several cuts. The depth of each cut was taken by adjusting the compound dial for each cut.

This setup is simple and any number of variations of it can be used to form various types of accurate tapers, balls, radii, either threaded or turned.

After successfully completing this job, we tried a few experimental cuts and found we could machine up to 16-pitch threads on tapers up to 58° but threads of any pitch could be chased on more gradual tapers.

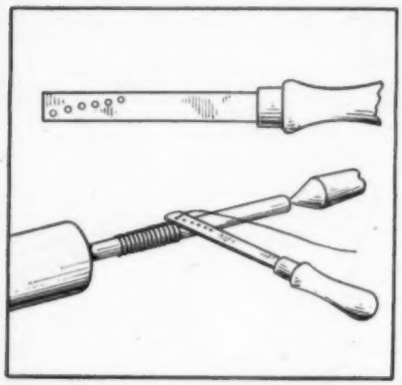
To make the bearing hold to the templet surface we used only the pressure of our thumb, but any kind of a weight or spring could be attached to do the same purpose.

Two Spring Winders

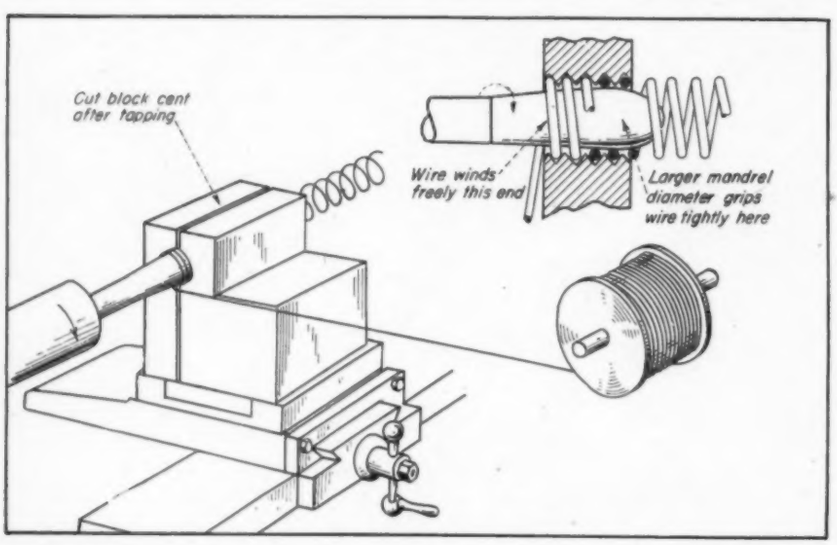
WALTER J. HOECKELE
Newark, N. J.

Compression springs of various pitches can be wound on a mandrel with this spacer. Flat, ⅛-in. steel is mounted in a handle and holes are drilled at increasing distances from one edge for the different spacings.

Tension springs have been successfully wound using a tapped-through hole and a suitable mandrel. The thread pitch is determined by the wire diameter; the wire should fit not quite flush with the crests, but the mandrel shape is critical. It must have a slight taper so the entering wire will wrap on the narrower portion, but as it feeds in, will grip the mandrel tighter. Depending on the temper, spring diameter and wire diameter, the finished spring will be somewhere between the mandrel's minimum and maximum diameter.



Flat blade tool has diagonal holes to obtain different spacings



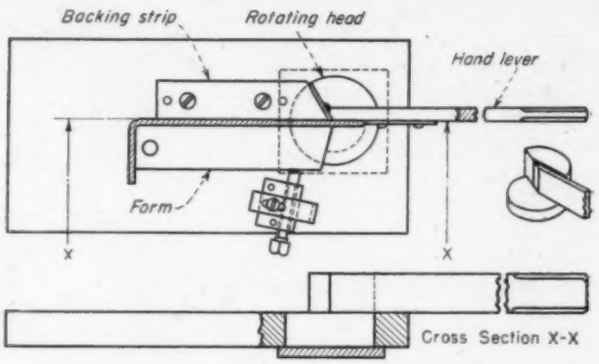
Threaded forming die and tapered mandrel produce tension springs

Hand Bending Fixture For Light Strip Stock

DONALD A. BAKER
Boonton, N. J.

In making models of various kinds we are frequently called upon to make bends in light steel, brass or aluminum of either square or rectangular section. As these parts require a fair degree of accuracy this fixture was designed and built.

The cast-iron body has a large hole at one end to receive the rotating head. This is held in place by a plate screwed on the bottom of the body and by the forming and backing strips. To this head a hand lever is welded. Forms are made up for the various lengths and thicknesses of parts and are held in place by a pin on which each is free to swing. A backing strip is doweled and screwed in place with its face aligned with the face of the hand lever, and both should be on the exact centerline of the rotating head. A block is screwed and doweled in place carrying a screw for opening and closing the former on the work. This is very necessary as otherwise it would be very difficult to remove work from the fixture once it was bent. This block also carries an adjustable stop for limiting the swing of the hand lever. This is used when making right angle bends to regulate the setting for proper springback.



A rotating head forms strip stock into uniform 90° bends while supporting strips on each side of the material hold it in place. A stop screw adjusts the lever for springback

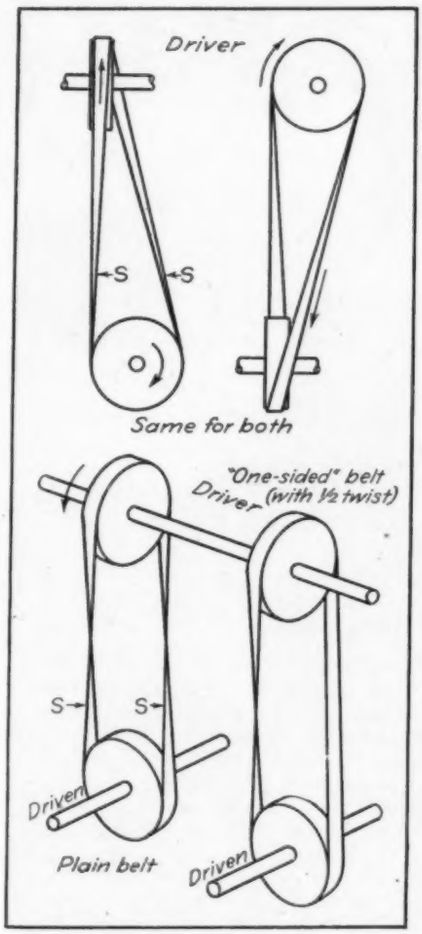
Half Twist Improves Quarter-Turn Belt Drives

PAUL C. ZIEMKE
Oak Ridge, Tenn.

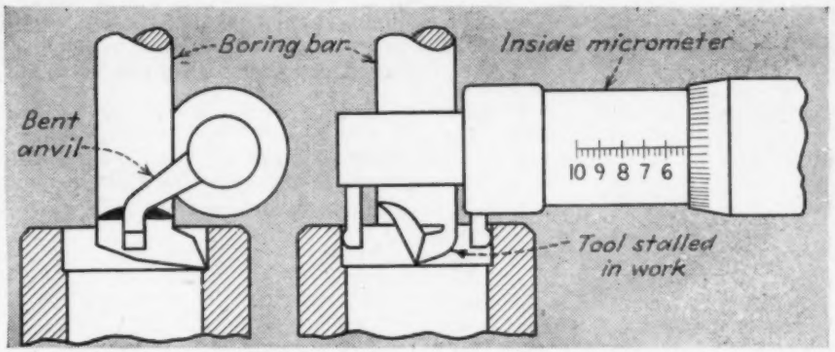
Most quarter-turn belts tend to run crooked in time due to the side pull peculiar to this type of drive. What happens is that one edge of the belt is stretched a great deal more than the other eventually causing the belt to become so deformed that it will continually run to one side and finally slip off the pulley. The uneven stretch will also cause the lacing or splice to let go long before its normal time. Through experimentation it has been demonstrated that this troublesome condition can be corrected by giving the new belt intended for the drive a half twist by turning one end through 180° before making the splice. This 180° turn works like a charm in that it causes the belt to change sides every revolution and thereby effectively causes the stretch to be well equalized. Actually, the belt has only one side! The edges of the belt reverse themselves on the pulley each revolution, and the one side has the area of both sides of the plain belt, thus dividing the wear in half. Quarter-turn drives should be so planned that the center should be at least five times the diameter of the largest pulley. Example: pul-

ley, 25 in. shaft centers, 125 inches. It is also good planning to provide a belt that is 5 to 10% wider as a factor of safety for quarter-turn drives. Finally, arrange to have the pulley on the vertical shaft the driver if one must be vertical. This is necessary since the tight side of the belt runs onto the pulley, the plane of which is horizontal.

However, in those instances where the belt is operated slack some trouble is bound to occur, especially where the pulley on the horizontal shaft is the driver. In the installation where the vertical pulley is the driver and the belt runs off taking up slack is the best way to correct it. The second best method is the trick of increasing the crown of the pulley on the vertical shaft.



In orthographic, the plain quarter-turn belt and the "one-sided" belt appear the same, but in isometric, it can be seen how the edge changing is accomplished. Trace your pencil around the edge of the twisted belt and you will see that there is not only just one side but only one edge as well!



Bent anvils allow caliper to gage holes without removing the tool

Bent-Leg Inside Mike Reaches Around Boring Bar

H. LANDAUER
Tampa, Fla.

For checking holes smaller than 1 in. during the process of boring we use plain calipers, a vernier caliper, a telescoping caliper or a jaw-type internal micrometer. For the use of all these tools, there is one feature in common: the tool has to be withdrawn in order to allow free access to the hole to be gaged. The wise operator, however, never takes a cut, near to the finished size, without checking it immediately after its first ⅛-in. tool travel, that is, after a strip has been formed, broad enough to bear the anvils or points of a gage. For the last cut, however, it is advisable not to interrupt the cutting process, as a groove will result when restarting, and as the tool sometimes takes another ½ thousandth off the "gaging margin," when traveling along it for a second time. So we have the alternative of obtaining a correctly gaged, but not perfectly clean surface, or a clean one, with a certain risk involved as to its correct size. The ideal procedure is, to start the cut and stall the machine *without disengaging the feed* after the land big enough for gaging has been reached, as in that case no groove or tool marks will result.

Sometimes a pair of spring inside calipers are slender enough, relative to the hole and the tool, to span the tool and gage the hole, and it is not too hard to bend the tips of a pair of calipers so the instrument can be brought up to the work parallel to the face and just the tips will enter the hole.

The bent-tip spring calipers will save much time and trouble on any job, but occasions arise where direct micrometer readings are preferable. If much internal boring or grinding is encountered, I feel that it definitely will pay to construct special anvils for the jaw-type internal micrometer caliper.

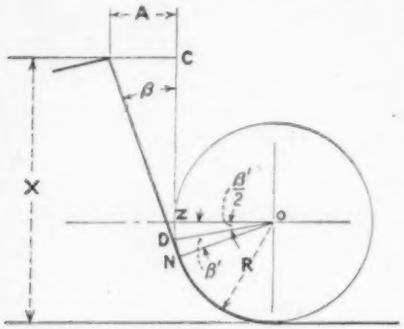
Blended Radius Form Tool Eliminates Shoulders

W. L. WOODCOCK
Alexandria, Va.

In producing screws and small parts on automatic screw machines it is definitely advantageous, where possible, to burr all edges on the machine, eliminating an additional operation for burring.

This is most commonly accomplished by incorporating the small corner radii on the forming tools used on the job. Everything works well except on the edge where the part is to be cut from the bar. Here, a full radius cannot be used on the tool as it will invariably leave a small shoulder on the piece; because it's practically impossible to line up the form and cutoff tools perfectly. So, in order to get a blended radius and face, the form tool is designed with a 10° to 30° tangent coming off the radius and extending from 0.010 to 0.020 in. beyond the end of the piece. The radius is not quite complete and a slight variation in the setting of the tools will not make a great difference in the appearance of the piece.

This method of design, however, presents a mathematical problem to the designer. In designing the form tool it is necessary for him to solve for the distance "X" so that he can give the required dimension on the tool. The known factors are A, angle B and the radius R.



Here is a blown up drawing of the problem and the method of solving it is as follows:

CD represents the line where the cutoff tool will cut. Line OD bisects the angle B' which is formed by constructing a perpendicular from N, the point of tangency, through O.

Now we have:

$$X = (CD - ZD) + R$$

but $CD = \frac{A}{\tan B}$ and $ZD = R \tan \frac{B'}{2}$

and angle B' = angle B; substituting, we have

$$X = \frac{A}{\tan B} - R \tan \frac{B}{2} + R$$

In order to avoid the above calculation each time a tool is designed the chart below gives the dimension "X" for the most commonly used figures for the radius "R," the angle B and the dimension "A." For unusual cases the designer may have to revert to the above formula but the following chart should suffice.

Slight misalignment between cutoff and form tools produces a shoulder, Fig. 1; corrected with a special radius

Angle B (in degrees)	"A"	"R"	"X"
10	.010	.010	.066
10	.010	.020	.075
10	.010	.030	.084
10	.010	.060	.111
10	.020	.010	.1225
10	.020	.020	.1317
10	.020	.030	.141
10	.020	.060	.168
20	.010	.010	.036
20	.010	.020	.044
20	.010	.030	.0525
20	.010	.060	.077
20	.020	.010	.063
20	.020	.020	.0714
20	.020	.030	.080
20	.020	.060	.1045
30	.010	.010	.0246
30	.010	.020	.032
30	.010	.030	.039
30	.010	.060	.061
30	.020	.010	.042
30	.020	.020	.050
30	.020	.030	.0566
30	.020	.060	.079

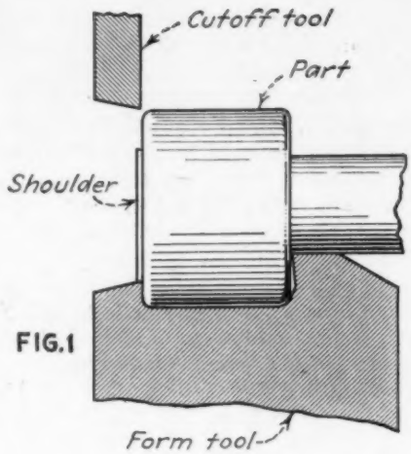


FIG. 1

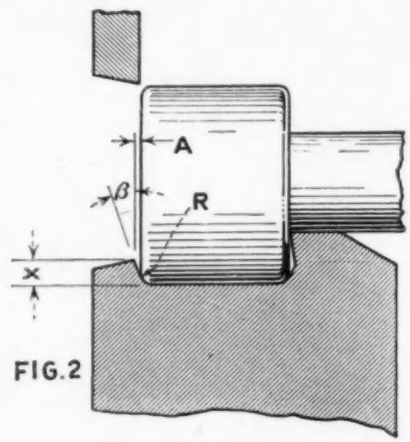


FIG. 2

NOW... $25 for the best Practical Idea in each issue

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Until further notice, an extra payment of **$25** will be made for the best Practical Idea in each number of *American Machinist*. To avoid bias, the selection will be made by readers, a different group each time.

Payment—$25 in addition to regular rates for the item as published, to be paid as soon as reader votes are received—usually three to four weeks after the date of the issue. The winner will also be announced in these pages as soon thereafter as practicable.

Judges—A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, will hereafter select the best Practical Idea. If at any time their votes result in tie, $25 will be paid to each and every co-winner. The decision of the readers will be final in each case.

Requirements—Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer or author—every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product—in terms of its usefulness to them.

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How to Enter—Send your entry to "Practical Ideas Editor," American Machinist, 330 West 42nd St., New York 18, N. Y.

Twentieth Selection—Earl Goddard's Tools
Twenty-First Selection—S. Framurz' Buttons

Britain Bids for Machine-Tool Markets

Study of British machine-tool builders reveals they are seeking most of future market abroad, improving designs, and working to maintain price advantage of their machines

BY F. R. BREWSTER

LONDON — (McGraw-Hill World News) — American machine-tool builders should prepare to meet stiffer competition than ever before from British firms in export markets during this year.

The British machine-tool industry, far from going into a slump as it did in 1919, has emerged from the recent war in excellent health, with a greatly expanded capacity in a plant a good deal more efficiently tooled than prewar, and still able to turn out machines at lower selling prices than American models.

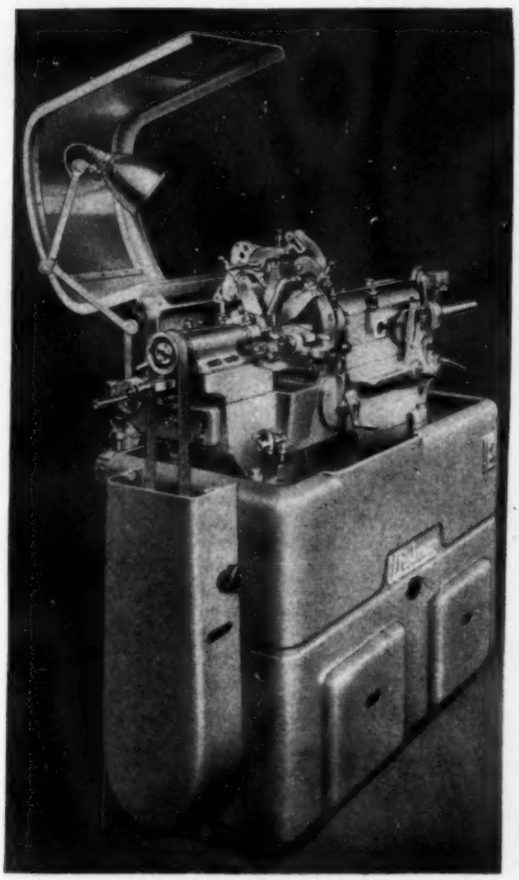
In spite of shortages of electric motors, ball bearings, necessary steel and other essential components, and constantly losing some of their skilled operators to the Forces, the British in 1946 have built approximately 45,000 machines worth about $80 million—roughly three times their output in 1936, which was the best prewar year before retooling for armament began to take effect. And, if they produce in 1947 at the level they reached in the second half of 1946, they will turn out nearly $100 million worth of machines this year.

Upon this foundation the British have already rebuilt a sizable export trade and are aiming at an even larger volume in 1947. The value of new British machine tools shipped abroad topped £8 million ($32 million) in 1946—an all-time high figure and more than double any previous year save 1944.

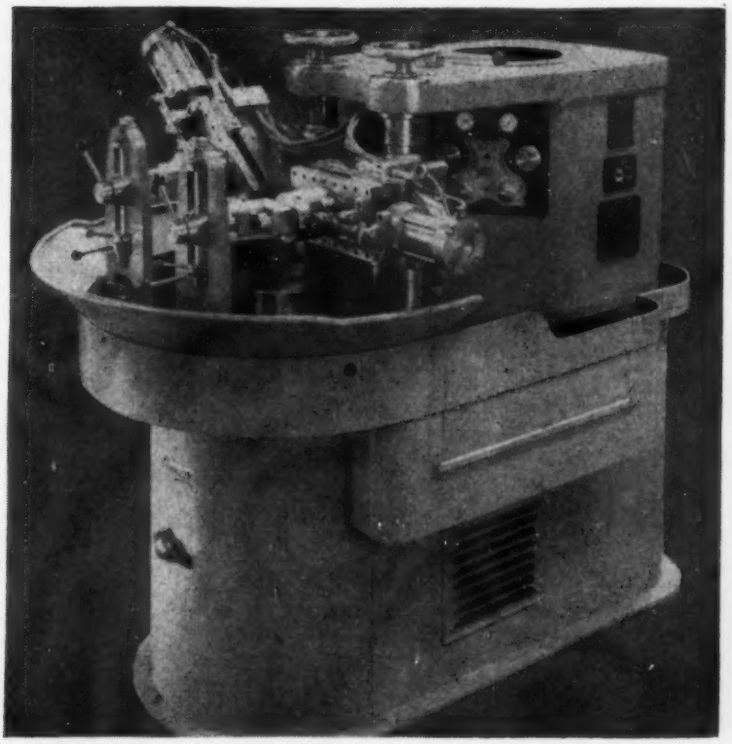
No one could deny, of course, that part of the British success has been the inevitable result of the sellers' market which has existed throughout the world. But an equally significant factor in the British accomplishment is a strengthening of their product designs. American tool builders, looking ahead to the years when the market returns to more normal conditions, years when they and the British alike will be scrambling for business, should take full cognizance of the present activity of their British competition.

The British government (through its Ministry of Supply) is the spur behind the export drive in machine tools, working mainly through persuasion, but backed up by powers over allocations of steel and other materials. The Board of Trade and the Treasury are lending their assistance in arranging trade agreements.

But, by and large, the continued success of the British in their export drive depends chiefly on the support given it by the individual firms themselves. While some firms are wholeheartedly behind the export



Left, 7/16-in. Swiss-type automatic made by A. O. Wickman Ltd. of Coventry has a sliding headstock and a tool bracket with five cutting tools carried radially. Below, an original British design, this Anderson Vertimax lathe by John S. Young Ltd. of Glasgow has a 15-in. swing and hydraulic feed



MACHINE TOOLS
PRODUCED & EXPORTED FROM FIVE MAJOR COUNTRIES

Year	United Kingdom			U.S.A.	Germany	France	Switzerland
	No. of machine tools produced	Value of machine tools produced (thou.)	Value of machine tools exported (thou.)	Value of machine tools exported (thou.)	Value of machine tools exported (thou.)	Value of machine tools exported (thou.)	Value of machine tools exported (thou.)
1929	.....	.....	£2,153	£8,401	£8,939	£933	£772
1930	.....	£4,876	1,856	8,093	9,821	876	689
1931	.....	.....	2,237	8,832	12,469	667	559
1932	.....	.....	3,144	3,960	13,321	632	416
1933	.....	3,236	1,265	2,255	8,903	575	574
1934	.....	4,637	1,610	4,320	6,350	568	815
1935	.....	6,531	2,443	6,075	5,775	620	1,103
1936	.....	9,347	2,014	9,277	10,276	561	1,359
1937	.....	8,452	2,151	13,001	14,825	833	1,603
1938	.....	13,300	4,473	19,892	14,247	937	1,977
1939	.....	19,050	4,579	22,809	10,780	785	1,707
1940	.....	29,200	2,044	51,214	.....	.....	.....
1941	81,000	30,450	1,721	46,247	.....	.....	.....
1942	96,000	33,543	4,621	39,855	.....	.....	.....
1943	76,000	31,308	2,783	59,358	.....	.....	.....
1944	60,000	25,764	7,803	40,900	.....	.....	.....
1945	48,000	20,796	4,535	20,379	.....	.....	.....
1946	45,000	20,000	7,392*	17,516*	.....	.....	.....

*1st 11 months.
Source: U. K. figures from Trade & Navigation Reports, as revised. Other figures from Engineering, War Production Board, National Machine Tool Builders Assn.

drive—many of these now shipping 75% or more of their current production abroad—others are lagging. An example of aggressive export-promotion activity on the part of firms of the first type is the Associated British Machine Tool Manufacturers Ltd.—a group of eight leading companies who have been banded together for export business since 1917. Simplifying their respective lines has allowed them greater resources to devote to design improvement, as has the more economical marketing arrangements which ABMTM has established through agencies in 26 countries and branch offices in Paris and Bombay.

Many other leading firms appear to be wary of such joint-action, preferring to rely on individually-appointed agents. Still others are only lukewarm toward cultivating foreign markets at all.

Export Markets

To attain the export goal they have set for themselves, the British realize they will have to look outside their prewar markets, which included the Empire and Commonwealth countries where their machines enjoyed a strong preference and met with little competition, and go after business from the European markets—France, Russia, the Low Countries and some of the Balkan countries—formerly supplied by the now-defunct German industry. And it is here, on neutral territory, that they will inevitably run into competition from American tool builders who themselves need greatly to expand their exports.

The table gives prewar machine tool exports from five major countries and provides some indication of the potential export market that lies open to British and American contestants.

Bank on Price Advantage

The British builders have as yet pulled no new tricks out of the bag to assist them in their selling campaign. Apart from appointing new agents and reestablishing contacts with former ones, the majority of British firms seeking export business appear to be content to rely on their prewar long-suit—their ability to turn out machines of a given performance at lower cost to the customer than competitive machines.

This lower selling cost becomes a still more telling advantage when it is considered that the bulk of the customers to whom the British are selling their tools are still more concerned with price than with special performance. Expanding industrial economies in India, South Africa and Australia still need large quantities of the standard machines. To a somewhat less extent but still significantly, the price factor is decisive in selling to France (by far Britain's biggest postwar customer) and to Belgium, the Netherlands, the Balkans, and that large imponderable, Russia.

In the present sellers' market, of course, delivery is more often the controlling factor than either price or performance in deciding the sale, and here again the British are in slightly better position, being able on most machines to quote delivery within 12 or 18 months.

Naturally enough, American machine-tool makers will take the measure of their British competition on the basis of its probable future "staying power." In other words, they will judge the British by the quality of the tools they have put on the market.

The British machine-tool industry has in the past confined itself generally to the production of the simpler general-purpose types.

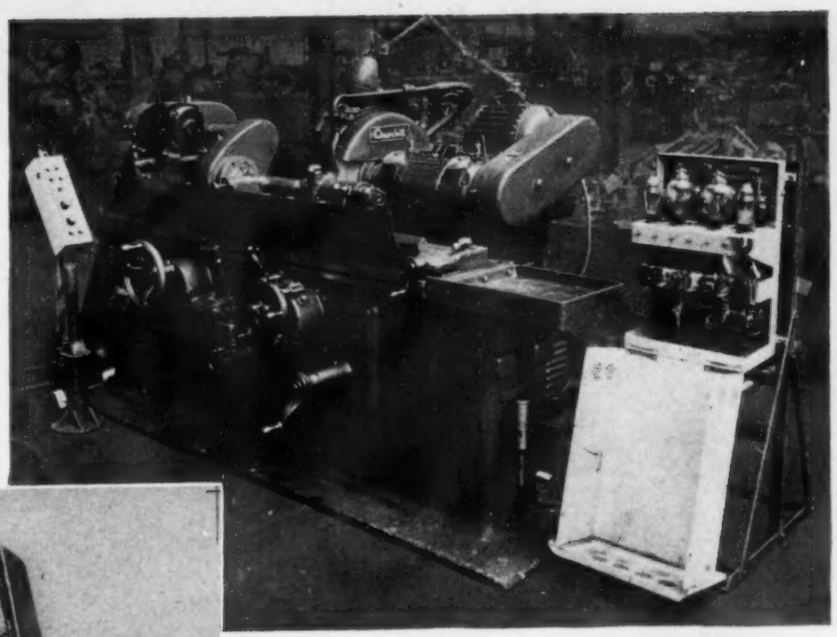
The British home market has put forth much less demand than in the U. S. for the elaborate special-purpose machine tools designed for high output with little regard for the price of the machine. Largely, this demand has not been forthcoming because of lack of enterprise on the part of British manufacturers as a whole. But a more dynamic influence on the direction taken in the past by British machine tool design has been the industry's own policy of producing to sell at a low price in order to compete with U. S. builders in the home market which for years has been largely unprotected. This decision has built up over many years a reluctance on the part of British customers to pay as high a price for any British machine as they would for a foreign design.

The combination of a small demand and a policy of selling always to a price has limited machine tool builders' resources available for development work. Even these resources were seriously depleted and in many instances swallowed up completely in the hard times which the industry endured following the 1914-1918 war. The possibility of joint activity by several firms to carry out design development, moreover, has been rendered difficult or impossible by reason of the fact that the industry as a whole is not large and a considerable proportion of the individual firms are small judged by American standards.*

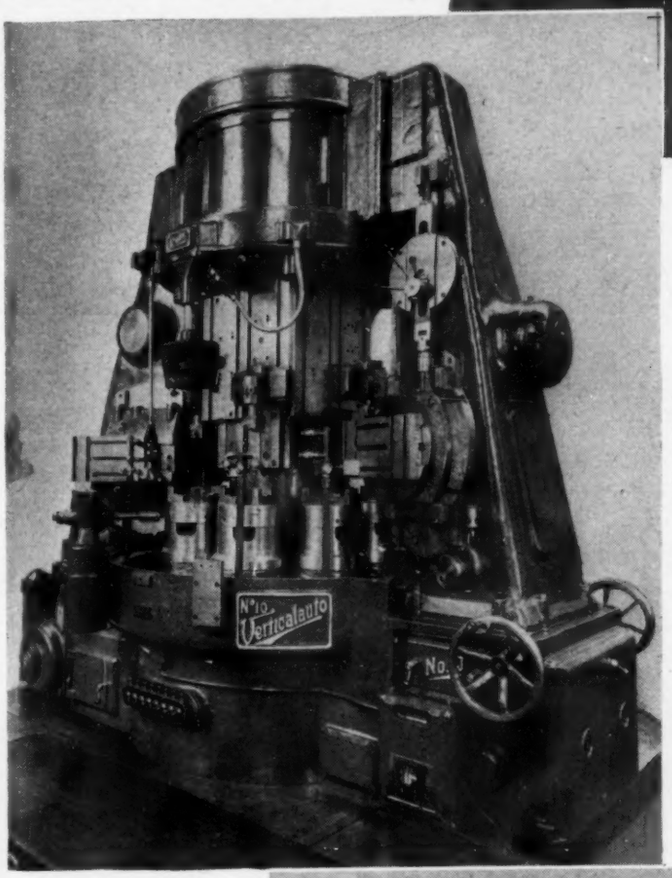
** In 1935, the latest year for which detailed figures are available, there were less than 150 firms engaged in machine-tool manufacturing, employing approximately 21,000. Of these firms 100 had less than 200 employees each and 50 of these employed less than 50 persons each. Today, there are only a few more firms in the business than in 1935, and although the industry is working at high pressure, employment is still estimated to be below 40,000.*

NEW DESIGNS BY BRITISH MACHINE-TOOL BUILDERS

Improved electronic control has been applied to the range of plain grinding machines made by Churchill Machine Tool Co. Ltd. of Manchester. The speed range is 12 to 1 with push-button control and infinitely variable regulation. The cubicle at right houses main transformer and rectifying equipment →



Developed from simpler types, the No. 10 Verticalauto is being put into production by Thomas Ryder & Son Ltd. of Bolton. It is made in a 6-spindle model with 15-in. chucks and 19-in. swing and an 8-spindle type with 12-in. chucks and 14-in. swing. Box-section side columns give rigidity and house independent drive for four cross slides ↓

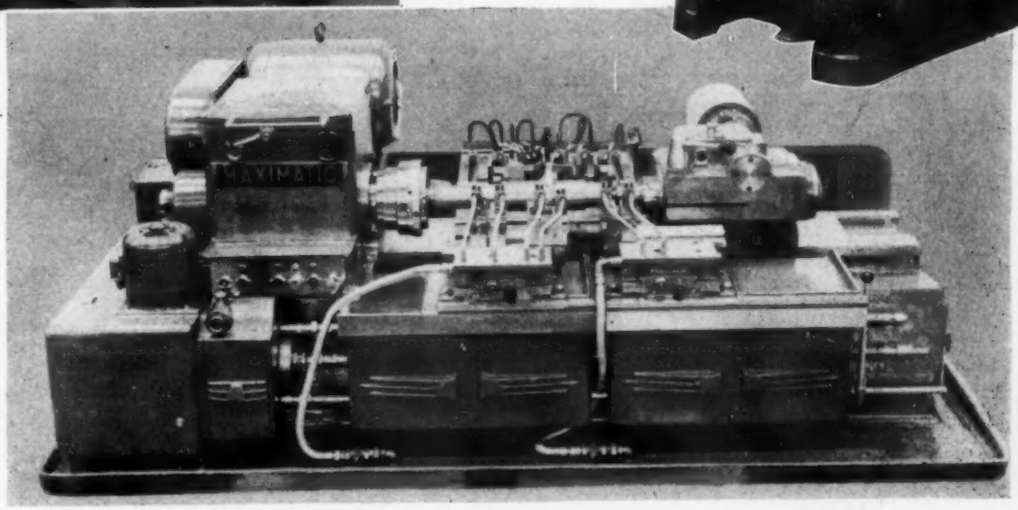


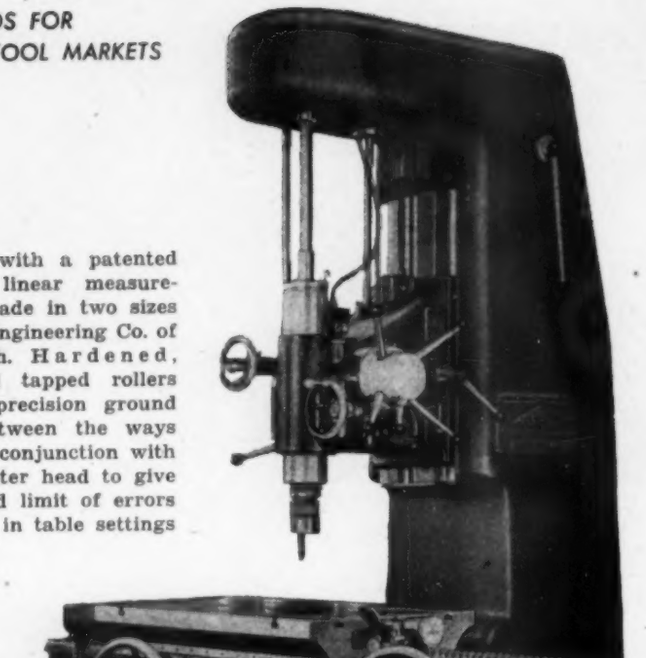
→

Built on the unit principle, presses ranging from 12½ to 60 tons maximum loading are made by E. H. Jones (Machine Tools) Ltd. of London. The all-steel frame is welded and annealed. Self-contained power unit and actuating mechanism are enclosed, and there is submerged oil bathing of load-carrying surfaces. Clutch control is interlocked with the safety control

→

The Maximatic automatic multi-tool lathe is built in a range of sizes by Drummond Bros. Ltd. of Guildford. It has independent drives to front and rear slides with infeed motions from lead screws at front and rear of bed. Longitudinal traverse of front saddles is from a second lead screw. Fast traverse can be introduced at any point in the cycle





Jig borers with a patented system of linear measurement are made in two sizes by Newell Engineering Co. of Peterborough. Hardened, ground and tapped rollers housed in precision ground channels between the ways are used in conjunction with the micrometer head to give a guaranteed limit of errors of 0.0002 in. in table settings

The situation began to change, however, in the years immediately before the recent war. The British rearmament program and the prospect of several years of steady business at a high level provided machine-tool makers with the resources and the stimulus to make further progress in design. Manufacturing industries were prodded by the imminence of war into a more enlightened attitude toward the purchase of high-production equipment, even though their plants still remained far below American standards of mechanization. These two factors combined to produce a noticeable general improvement in the design and engineering of British machine tools.

Design Changes

During the war, although many makers' lines were trimmed to only one or two types, the special demands of the industries supplying the armed forces led to the development of some new types of machines, and to cope with the severe treatment which machines received at the hands of unskilled labor and under the stress of overloaded production, many improvements were introduced in design features and some in the quality of manufacture of the tools. In addition, quite a few firms found time for some postwar development work.

The backbone of the British machine-tool industry, of course, is undoubtedly the standard general-purpose machine. Outstanding in this field at present are their engine lathes, capstan (ram-type turret) and turret lathes, and internal and external grinders. These machines are commonly bought by British manufacturers on considerations of quality and efficiency alone, irrespective of any price differential. One British maker of capstan lathes, incidentally, laid out his shop during the war for a peak production of 300 machines a week, and the physical capacity for this level of production is still there. Other machines with which the British builder has been very successful in home and overseas markets alike are the heavier types of presses, shearing and bending machines, etc., which are made in limited quantities.

In recent years, however, and increasingly evident since the war, British tool builders have ventured farther and farther into the design of high-production types of machine tools. It is in this field, in particular, that several British firms have capitalized on the developments made by U. S. and other foreign designers, showing considerable enterprise in the modification of these designs to give improved performance. A number of these new British developments are shown in the accompanying illustrations.

Two firms, for instance, are now producing Brown & Sharpe type screw automatics. The latest firm to do so has only recently entered this field and has just extended their range by bringing out a 1¼-in. capacity machine. Another firm which started building a Fellows-type gear-shaper in the 1930's has now introduced considerable modifications into their design, to provide convenience in handling and setting.

Developments by the British in high-production design are not limited to these adaptations of foreign types, however. Here are a few examples of original work by British designers: A new multi-spindle vertical automatic lathe has been introduced recently which is truly original even though basically similar to a U. S. machine. The Newall jig-borer, developed before the war, has been improved in detail and is now equipped with electronic control. An enterprising Scottish mechanic has just perfected a small single-spindle vertical automatic with hydraulic feeds. A British lathe manufacturer of some standing recently announced a good-looking engine lathe of 21-in. swing which has all the trimmings.

Adapting German Design

Future developments are likely in both of these directions, since the British Government is making considerable effort through the Machine Tool Advisory Council to stimulate development work throughout the industry. In the direction of adapting foreign designs, it is understood that at least one well-known German machine, the Index screw automatic, is likely to be manufactured in England, and other announcements along similar lines may be expected, following on the heels of the demand that was evident for drawings of German machines when they were made available in London.

But good as many of these British-made machines are, they are outstanding examples and do not represent a wholesale swing to high-performance tools within the British machine-tool industry. U. S. makers still have little to fear when their machines compete with British on a performance basis alone, in the export market. But when it is a question of price combined with performance, as it frequently is in the overseas markets where production requirements are so much less exacting than they are in American factories, then the current products of British machine-tool builders are likely to provide some stiff opposition for the American industry.

NEWS OF METALWORKING

Machine Tool Show Next September To Be World's Largest Exposition

The 1947 Machine Tool Show, first of its kind to be held in 12 years, will be staged at Chicago in the Dodge-Chicago plant from September 17 through September 26, according to an announcement by Herbert H. Pease, president of the National Machine Tool Builders' Association.

This show will have the distinction of being the world's largest exposition of a single basic industry. It will, in fact, be the largest industry exposition ever held, occupying 500,000 sq.ft.

The theme of the show will be "more goods for more people at lower prices." There will be more than 250 exhibits of machine tools, forging machines and other metalworking equipment in operation. Latest designs in metalworking machinery—new methods, new materials and new products—and every development that improves quality of durable-goods production will be shown.

Advance Registration Planned

Lease for the space, part of the 94 acres of the war-built plant, has been taken over by the National Machine Tool Builders' Association from the War Assets Administration and the Tucker Corp., which now occupies the plant.

Admission to the show will be by invitation. Leading industrialists from home and abroad, as well as supervisory production and engineering personnel, will attend. Advance registration will be arranged through the association's office at 10525 Carnegie Avenue, Cleveland 6, Ohio.

Show to Run 9 Days

The show will be open daily for nine days from 10 a.m. to 5 p.m. Technical sessions of the Machine Tool Congress will be held each evening at various Chicago hotels, headquarters for participating groups.

The association has staged three previous shows: in 1927, 1929 and 1935. All of them were in Cleveland. Some 60,000 industrial executives and technological experts attended the 1935 show. They came from every State in the Union and from every industrial nation in the world.

Bergstrom Heads Committee

Swan E. Bergstrom is chairman of the show committee. Other members are William L. Dolle, R. W. Glasner, Helge G. Hoglund, Ralph J. Kraut and Louis Polk. Directors of the association are Mr. Pease, Alexander G. Bryant, Lloyd D. McDonald, Louis Polk, Harry W. Bockhoff, Albert M. Johnson, William L. Dolle, Fred W. McIntyre and Herbert L. Tigges.

The show will be managed by the New York firm of Clapp & Poliak.

Ordnance Chief Recommends Scrapping Obsolete Equipment

WASHINGTON—Much war equipment now held in standby will be obsolete for any emergency a few years hence and should be sold or scrapped, says Maj. Gen. Everett S. Hughes, Army ordnance chief, after an inspection trip. On the other hand, materials worth keeping should have better care, he contends.

The ordnance expert, who was Inspector General for Eisenhower in Europe, approves dehumidified "can" containers for weapons and equipment. But they are sealed and contents cannot be seen, and he would like to put more reserve equipment under roofs. The "cans" are mostly stored outdoors.

Gen. Hughes has no opinion on the new spray preservatives as yet, because it is still under experimentation. Hughes emphasized again that he favors research and development rather than accumulation of equipment made from current design.

Even military vehicles may go obsolete; most of them are for hard standing operation, whereas future wars may require running on unprepared terrain and water. Developments should keep pace, he said.

Largest Machinery Casting — United Engineering and Foundry Co. of Pittsburgh have turned out what is reputedly the world's largest steel machinery casting, weight 472,000 lb, to be used as a frame for a 6,000-ton Ajax mechanical forging press. The pattern alone required 30,000 ft. of lumber, 500 lb. of nails, 10 gal. lacquer and 2,500 man-hours of labor. The mold required 1,250,000 lb. of molding sand and a pouring pit big enough for a small house. Four open-hearth furnaces, pouring simultaneously, delivered 600,000 lb. of molten metal in 4⅓ min. The casting was cooled for two months and removal of cores, heads, gates and risers took another month. A special 90-ft. freight car delivered the casting to Ajax Mfg. Co., Cleveland, Ohio.

Gaging Business

Top Production Looked For

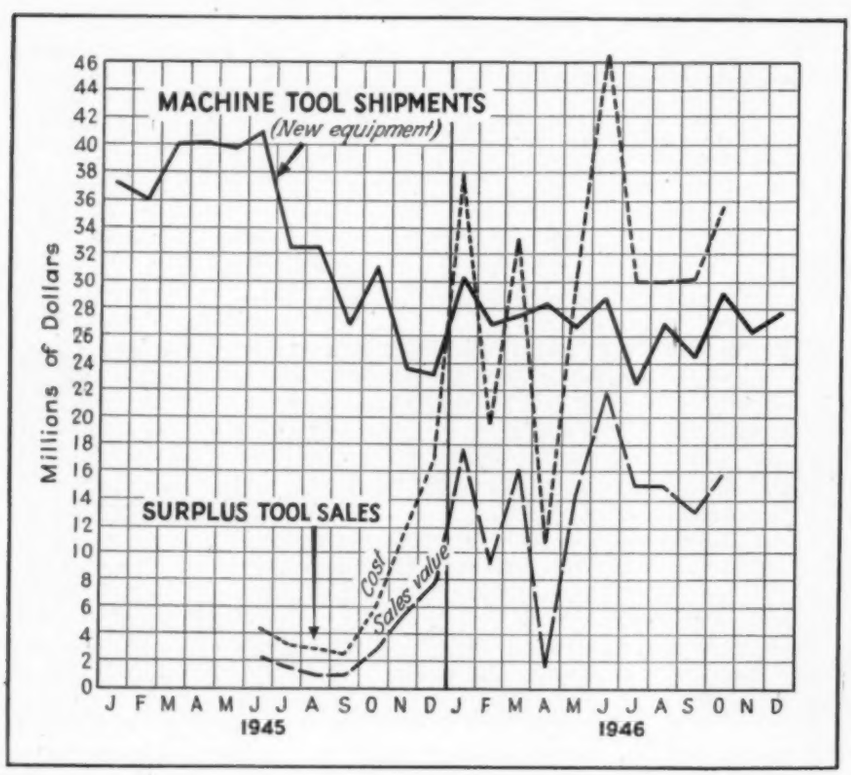
Willingness of union leaders to extend present contracts while negotiations are on for new agreements gives encouragement to the belief that metalworking industries are in for a stretch of top production relatively free from strikes. Most metalworking companies have fairly large backlogs, and many have order books which insure full operations all year. The biggest headache still consists of getting necessary parts and materials. In some cases automobile makers, whose orders for machinery are being delayed because machinery builders cannot obtain castings, are going direct to foundries to see what can be done to speed shipments.

Stainless Steel Breaking Records

Pent-up demand for stamped stainless steel products, such as kitchen utensils, dairy equipment and chemical and textile equipment, is so great that existing fabricating facilities are inadequate. One large fabricator has a 5-year backlog, and other companies are in almost as tight a spot. The expanding market for stainless demands a substantial increase in the number and plant capacities of fabricators.

Steel Production Near Capacity

Steel output has risen to 93% and is expected to stay at the highest point since the war ended. With extension of U. S. Steel's contract with the steel union until April 30, the chances of a major strike are fading. Steel companies generally are not accepting new orders beyond the second quarter. Weirton Steel got its new 66-in. strip mill into operation Jan. 29. When this mill gets going full tilt, Weirton's strip production will be increased 50% over the 48-in. mill now replaced. New mill has rated capacity of 135,000 tons of hot-rolled strip a month. Predictions are being made in reliable quarters that stainless steel will set a new record this year both in production and in application.



Year-End Report on Shipments—Machine tool sales rose to $27,587,000 in December, bringing total shipments for the year 1946 to $325,448,000, according to the National Machine Tool Builders' Association. The 12-month total of new orders was estimated at $307,313,538. Foreign shipments in December reached $8,445,939, the highest of any month during the year.

Freight Car Shortage Acute

With freight car shortage worse than last year, Office of Defense Transportation is seeking means to channel over 1 million tons of steel to freight car builders so that they can produce 10,000 cars a month during '47 and keep existing cars in repair. Car orders by Class I roads totaled 63,829 units on Jan. 1. Timken is preparing to turn out at Canton 8000 bearings for 1000 new steel hopper cars just ordered by Chesapeake & Ohio. It will make 100 car sets a week. Pennsylvania Railroad has bought 11 diesel-electric locomotives from Electro-Motive, nine from Baldwin and five from American Locomotive. Government of India has ordered 16 steam locomotives from Baldwin for September delivery.

Rise Expected in Tool, Die Work

A gradual rise in contract tool and die shop work is expected as a result of the trend toward more elaborate tooling as a means of lowering production costs. Dollar value of dies, tools, molds and other special tooling shipped in the last two months of 1946 was 25% above that in the same period of 1945, according to National Tool & Die Manufacturers Association. Incoming orders in December, however, declined 15% from the November level.

Builders Moderately Busy

Despite severe competition from surplus government stocks, machine tool builders are moderately busy. It is believed that tooling programs for new automobiles soon will give new impetus to machine tool orders. For one thing, work on new machines for the light Chevrolet, suspended for a number of weeks, is about to be released. Most incoming business consists of orders for two or three machines each, contrasted with wartime orders for 20 or 30 machines at a time. Export sales continue to comprise more than 25% of the total.

Sweden Placing Orders

Sweden and Switzerland have been outstanding purchasers. Little business has come out of France lately and not much is anticipated until new financing is provided the French government. Deliveries of new machines are being held up by many builders because of continuing shortages of castings, bearings and motors. Sales task of machine tool builders will be made even harder when WAA transfers on Feb. 15 a third list of surplus general-purpose machines to the "fixed-price" category.

Foreign Nations Get $15,717,964 Worth of Machine Tools from U. S.

WASHINGTON—Through UNRRA, the United States, Canada and the United Kingdom gave $26,427,732 worth of machine tools to war allies and distressed countries abroad. The United States contributed more than half the amount, $15,717,964.

▸ Programs with different countries began at different times. This tabulation, compiled by AMERICAN MACHINIST from records of United Nations Rehabilitation and Relief Administration, covers allocations up to Nov. 1 in some cases, Jan. 1 in others.

Limited to Rehabilitation

Beneficiary countries are permitted to operate the machines in government-controlled industries, or they can sell them to citizens, for their own currency, and apply the proceeds on their own relief problems.

▸ Recipient countries agreed not to use the tools in setting up new industries, but only to rehabilitate those damaged or depleted by war. UNRRA believes it is more economical to give the countries means with which to help themselves than to give them direct relief.

Competition Might Follow

Officials of the agency say recipient countries, having experience with American machines, will buy parts from U. S. manufacturers like those given them. In some cases, they admit, rehabilitation of foreign industries with gift tools will tend to put them back in competition against this country. But, they add, that is often true of machine tool exports for cash.

▸ UNRRA commitments to foreign countries have been terminated, but shipments of machine tools will continue for some months yet.

▸ A breakdown of the worth of machine tools given by the three nations to various countries abroad follows:

To Poland	
From United States	$7,113,133*
From Canada	29,623
From United Kingdom	119,227
To Ukraine	
From United States	832,990
To Yugoslavia	
From United States	5,093,853**
From Canada	6,799
From United Kingdom	1,017,148
To Albania	
From United States	63,246
To Austria	
From United States	62,971
To Bylo Russian Republics	
From United States	535,925
From Canada	16,378
To China	
From United States	855,763
From Canada	297,859
From United Kingdom	893,136
To Czechoslovakia	
From United States	148,758
To Greece	
From United States	1,011,325
From Canada	80,095
From United Kingdom	154,530

*Includes $1,200,000 military surplus.

** Includes $1,000,000 military surplus.

AAF Seeking 12,500 Machine Tools For Storage to Meet Emergencies

NEW YORK—As an integral part of its Air Industrial Program, the Army Air Forces is preparing to store 12,500 machine tools left over from World War II. The types to be stored are basic to airplane construction and are being assembled in sufficient quantity to allow for immediate expansion of military aircraft production in the event of another emergency.

Experience in World War II showed conclusively that the immediate demands of the AAF for machine tools were considerably greater than the peacetime industry could provide. Present estimates are that the AAF needs in the first year of any future mobilization would total around $300 million, which contrasts with the industry total of $195 million produced in the prosperous peacetime year of 1937.

War Assets Corporation warehouses, government-owned aircraft plants and military depots are being combed by skilled AAF personnel for tools in near-new condition. Machine tools meeting requirements will be shipped to an AAF depot where they will be prepared for extended storage. Maintenance, according to the AAF, will be continuous, with warehouses checked daily. They will be subjected to periodic inspection and servicing.

Chicago Metalworking Firms Roll In High Gear; Appeal for Workers

CHICAGO—Metalworking plants in the Chicago area, in contrast with those in some other sections of the country, are hiring new workers instead of cutting back on employment, a survey discloses.

▸ Pullman-Standard Car Mfg. Co. needs 800 men, in both skilled and semi-skilled categories, and is preparing an intensive advertising campaign to recruit them. Among the inducements that will be offered is assistance in obtaining housing. Carnegie-Illinois Steel Co. needs 3,000 men, mostly unskilled, and Inland Steel is seeking 700 more workers.

▸ International Harvester already has a work force of 29,000 but needs 1,000 additional employees, including professionals such as engineers, draftsmen and office workers.

Wartime Peak Topped

Western Electric Co. has a payroll of 36,500, against 25,700 at the wartime peak. Nevertheless, the company is searching for more employees, especially skilled male help and women for assembly operations. Hotpoint, Inc., has 3,300 persons on the payroll and plans to increase the number to 4,500.

▸ J. I. Case Co., which has been closed down at Racine, Wis., for more than a year by a strike, has obtained possession of a plant at Bettendorf, Iowa, from the War Assets Administration. Case intends to hire more than 2,000 workers at the plant.

Higher Production Predicted

Leon R. Clausen, president of Case, estimates the new plant, which cost the company $1,123,000 cash, will produce one-third more than the output of the Racine plant at full production. He has not disclosed how much of the Racine farm machinery activities will be transferred to Bettendorf, but it is generally understood that, with the long strike showing no signs of settlement, some of Racine activities will be moved.

▸ Although space in manufacturing buildings remains unobtainable in Chicago, there is plenty of room for new industrial buildings. Industrial developments in 1946 were exceeded in the past only by two peak war years, and 1947 expansion is expected to exceed 1946.

▸ Industrial developments in the Chicago area in 1946—including new plants and additions, purchases of sites for future building, and purchases of existing buildings—aggregated $184,500,000. Despite scarceties of building materials and high costs, new projects are getting under way daily.

OWMR Takes Over Non-Ferrous Plan; Supply Shortage Will Remain Acute

WASHINGTON — The Premium Price Plan for Copper, Lead and Zinc, formerly administered jointly by OPA and CPA, has been consolidated under the Office of War Mobilization and Reconversion. The plan's new name is the Office of Premium Price Plan, effective Jan. 27.

▸ Under the new setup, Harold Stein, OWMR commissioner, is the final authority for payments and operations. Clarence O. Mittendorf, former OPA representative on the quota committee, is director of the new office. Personnel of the plan will remain, although some jobs will be redefined.

▸ Meanwhile, supply and demand for most non-ferrous metals will be all out of reason again this year if the country is not crippled by lengthy strikes in either producer or consumer industry.

Aluminum Far Off Demand

Substitution of one metal for another, usually the controlling factor in price ranges, cannot be considered to any degree this year because of the across-the-board shortage.

▸ Aluminum, which is a threat to copper and zinc as a substitute metal, will be in very short supply. A continuing shortage of soda ash will limit production to about one billion pounds, 500 million pounds short of demand.

Copper, Lead Short

Copper will also be in short supply. Domestic mine production will total about 900,000 tons, if mines stay open and at peak production. Demand has been estimated at about 1,500,000 tons. Lead is short the world over, and will remain so for many years. Production this year in the U. S. has been optimistically estimated at 350,000 tons. Even imports matching last year's total, 150,000 tons, will only swell the total possible supply to less than half of industrial demand.

▸ Tin, the only metal still under quota and import control because of continuation of international agreements for world allocation, will be in slightly better supply than last year. Allocation increases will depend on improvement of imports from the Far East.

▸ Zinc is the only metal which is likely to be in balance of demand. A potential shortage of prime western grade, used in galvanizing, depends on increased production of strip steel. Steel production is the answer to a shortage of galvanized sheet, not zinc.

Sebastian Lathe Added To King Machine Tool Line

CINCINNATI—King Machine Tool Co. has taken over, as of January 1, manufacture of the Sebastian lathe. Sebastian Lathe Co., which has built the machine since 1885, becomes a division of King, and engineering developments will hereafter be taken care of by the King engineering staff. D. C. Morrison, former president of Sebastian, will act as worldwide distributor.

There is no intention to change weight or price range. Lathes will be built in the modern King plant, along with the King line of vertical boring and turning machines, in 12-, 14-, 16-, 18- and 20-in. models, and, as formerly, in the medium-weight, medium-price range.

Research Project to Establish Precision Casting Possibilities

CHICAGO—One of the first projects under the Department of Commerce government-industry joint research and development program is expected to be awarded to Armour Research Foundation for a study of the possibilities of precision casting. The research program is expected to stress the small business possibilities in the field, and to discover whether enough potential outlets exist for precision castings under peacetime conditions to make new ventures profitable.

▸ Crane Co., which has concentrated most of its efforts since the war on plumbing and heating equipment for low-cost housing, is planning to swing into production of higher priced lines.

▸ Increased demand for valves and fittings is expected to result from a greater volume of industrial construction. While shortages of pig iron and steel have limited output, the company has not been seriously hampered. If new construction materializes on the expected scale this year, Crane anticipates a record production level.

▸ Oliver Corp., maker of farm implements, is still plagued by shortages of steel and motors, but reports that some items are in noticeably better supply—such as clutches and bearings. The company also says that labor conditions are improving—absenteeism and labor turnover are down, and workers are showing less inclination to migrate.

Steel Backlogs Average 8 Months With Heavy Demand in All Items

PITTSBURGH—On the whole, it is estimated that backlogs in steel average about eight months, although some may be inclined to say the balance of the year. Some of the backlogs, of course, can be cut down sharply (1) in the event of a recession in business and (2) some substantial increases in allocation of raw steel to finishing mills.

It is not to be supposed that new sheet capacity will permit much increase in semi-finished movement to other types of finishing mills. In respect to a recession, opinion is that either it will be mild, or will affect steel output slightly. The demand is too great.

In shapes and plates, mills not selling on a quarterly basis are booked for months ahead. The growing optimism in respect to construction which can be completed in 1947 means greater need of shapes.

A summary of oil and natural gas line pipe requirements for projects approved for 1947 and beyond indicates need for line pipe 1½ times the ability of mills to supply it.

Wire and tin plate demands show no evidences of easing and these mills are expected to be tight all year.

Scrolls Given U. S. Firms to Mark China's Thanks for Training Help

NEW YORK—An impressive array of industrialists prominent in metalworking fields today hold scrolls—symbols of China's gratitude for their cooperation in providing on-the-job training to Chinese technicians during World War II.

The scrolls bear a message from Generalissimo Chiang Kai-shek:

"Now that the wartime training program has come to an end, I most sincerely hope that some means may be found to continue this important work. China is in desperate need of men and women trained in modern technological methods and we look to America to aid us as we face the critical years ahead."

The Chinese president expressed his thanks for "a contribution of far greater value than you perhaps realize toward helping us solve our vast reconstruction program." His message was delivered to the industrialists by China's Ambassador, Dr. V. K. Wellington Koo, at a dinner given Jan. 27 by the China Institute of America.

Many of the industrialists indicated they will continue assistance by training Chinese technicians in peacetime operations.

Detroit

TOOLING SHOPS IN TEMPORARY LULL . . . DUMPING OF $58 MILLION IN SURPLUS TOOLS HIT . . . LIGHTER METALS GAIN LITTLE GROUND

Active Tooling Ahead

Some large shops in the tooling field claim only the tag ends of programs are being placed today, and there is a lull which may run from a few days to as many as 60 before new work begins to be placed. Meanwhile there is intense competition for such work as is available, which may mean bargains can be had for a limited time only.

Indication that a more active phase of tooling is immediately ahead is found in the position of the pattern-making shops. Metal pattern shops are working at capacity, and skilled men are hard to find. Ford Motor Co. has been advertising for workers in this category.

Among the wood pattern shops, the picture is not quite as good; rates are probably 10% or so away from capacity, and expectations are that a pickup from this level may not come before mid-March or thereabouts.

Patternmakers Get Boost

It might be noted that patternmakers in the Detroit area have recently profited by a 25¢ wage increase across the board negotiated in a new contract between the shops and the AFL union involved. Average rates for metal men is now somewhere around $2.55 an hr., for wood men, 20¢ or so higher.

Surplus Dumping Assailed

Cutting tool companies are unhappy, indeed, over word they received from Washington in January that agency contracts for surplus disposals would be discontinued. Contact was promised later on disposal of tools on hand.

Detroit cutting tool makers and their association, who originated a blueprint for disposal of surplus tools through distribution channels of the original makers, were annoyed upon learning War Assets Administration had dumped $58 million in tools onto the open market on competitive bids. Some executives said it will bring a normal peacetime production of somewhere around two years' duration into distress channels, and will make a severe crimp in plans and projections of manufacturers.

Plan Counter-Sales Argument

They plan to meet the situation with a hope and a good sales argument. They hope that such a staggering quantity of cutting tools on the market will so clog up actual means of identification that resulting confusion will all but eliminate movement. This may prove exceedingly true. The sales argument is that many surplus tools, particularly drills, reamers and taps, were made during war conditions which necessitated use of lean steel or substitute alloys, and that today's tools are made of full alloy, longer wearing and more dependable material.

"War of Metals" Dims

The much-pubicized "war of metals" has not materialized at all in automotive plants and plans, this being in line with informed anticipations all along. Plastics, aluminum, and magnesium still have a way to go before they can replace steel in significant automotive applications.

One company pursued a thorough experimental program during 1946 to see whether it might replace steel with a clad aluminum sheet in an underside section. The objective apparently was to reduce weight and hold costs about constant.

Project Halt Unexplained

The testing was to develop whether conventional welding, as practiced in auto body shops, might be readily applied to the aluminum section, and particularly if precleaning of the aluminum sheet could be eliminated. The final conclusion was that it could—but the project was discontinued. There was no ready reason for the stop order; indications were simply that the idea had been put on the shelf for the time being.

One reason, of course, might have been the current tightness of aluminum. This is ascribed by men in that industry to the failure of aluminum scrap to return to productive channels in the quantities expected, and to the postwar shutdown of two of the three DPC strip mills which had been furnishing such a heavy proportion of output in that department.

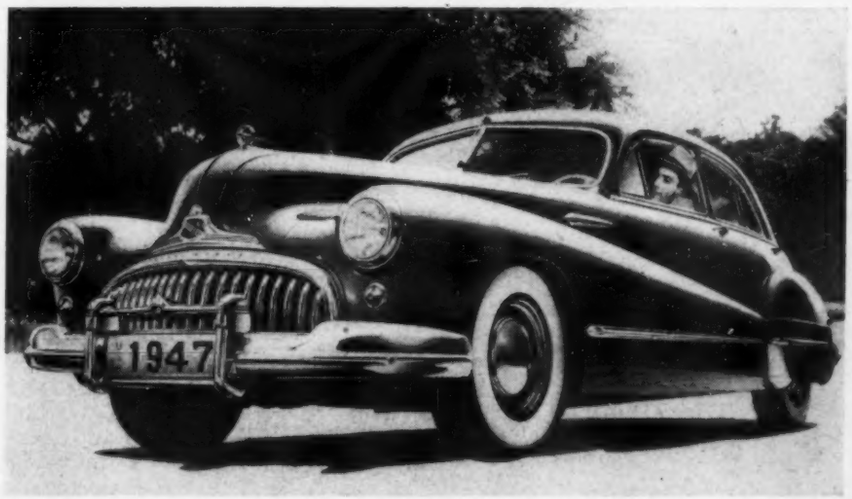
Testing Stipulations

The automotive application mentioned was based on these rather interesting requirements in addition to the no-precleaning stipulation: Conventionally designed AC welders had to be employed, along with ordinary tap water as coolant, and some 2,500 spots were specified between electrode dressings. Surface appearance was not important.

Successful tests used 150 KVA welders equipped with magnetic timers. Using 150-lb. pressure and 19,000 amp. current, they produced around 6,000 spots between dressings, with shear strength averaging 403 lb. A flat face electrode was employed.

Brass Used for Gaskets

A few switches from steel to brass are noted in the automotive field. Brass is being used as a substitute in certain cylinder block gaskets which heretofore have been of steel, with an asbestos filler. Brass is also cropping out as a material for various stampings and accessories.



1947 Buicks in Production—Featuring functional styling with a streamlined body by Fisher, the new 1947 Buicks began production early last month with an initial output of 1,100 units daily. Made in three series and nine body styles, it also features noiseless windshield wipers and a venti-heater which provides cool air in summer and thermostat-regulated warm air and windshield defrosting in winter

Curbs on Foremen Unionization Seem Certain; Case Bill Backed

WASHINGTON—Wagner Act assistance in the unionization of shop foremen will be restricted, and possibly wiped out, by Congress—if the Supreme Court doesn't do it first.

This seemed certain to Washington o servers as Congress worked busily a new labor legislation with a determination to curb union excesses and devise machinery which might help settle disputes without strikes.

Capitol Hill Republicans propose to deny some foremen, or all of them, the right to seek union recognition through the protective machinery of the Wagner Act, while at the same time allowing employers to grant it voluntarily if they wish. This also means foremen could strike against unwilling employers, but would run the risk of discharge.

2 Foremen Bills Differ

Two leading bills on the foreman question are the Ball-Taft-Smith bill in the Senate and the Case bill in the House. They differ, however, in this respect:

▸ The B-T-S proposal would deny Wagner Act support to supervisors as well as to inspectors, time study men and many other groups of non-production workers, irrespective of the type of union involved.

▸ The Case measure would give protection to a foreman's union so long as it did not admit production workers and remained unaffiliated with the AFL, CIO or any other union of rank and file employees.

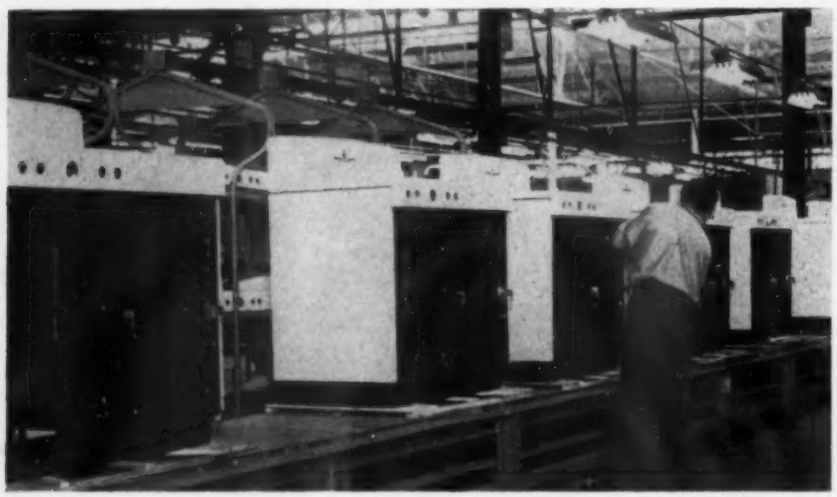
In other words, Rep. Francis Case would uphold the National Labor Relations Board recognition of the Foreman's Association of America, an independent union, but would knock the props out from under John L. Lewis' District 50, which seems to bargain for coal mining supervisors.

Case Views Win Support

Labor Secretary Schwellenbach virtually endorsed Case's views in his testimony before the Senate Labor Committee. A similar position has been taken by James J. Reynolds, Jr., newest member of the three-man NLRB. This, coupled with the prevailing sentiment in Congress to curb foremen's bargaining rights, practically assures that at least foremen unions connected with production workers will lose government support.

▸ Aside from Congressional action, FAA's status hinges on the Supreme Court decision in the Packard Motor Car Co. case. A defeat for the union would weaken its organizing possibilities and likely bring some strikes. But even if the court upholds NLRB's certification of this independent union, the broader question of the Wagner Act rights of an affiliated or mixed union still will need to be clarified.

Such clarification would come in the Jones & Laughlin Corp. case, now headed for the highest court, unless earlier action by Congress made the question academic.



Complete Redesign—Before a single postwar range was built the Kalamazoo Stove and Furnace Co. put $2,500,000 into tools and dies, redesigning plant and product and scrapping old tools. Now one unit will come off the 2 1/3 miles of conveyor line every 20 sec. and about 80% of all range parts will be conveyorized. Gas and electric range design achieves 65% interchangeability

REUTHER, MacGOWAN OPPOSE JURISDICTIONAL STRIKES

WASHINGTON—Organized labor cannot in good faith oppose President Truman's proposal for a ban on jurisdictional strikes in the face of recent statements by CIO and AFL leaders.

"Jurisdictional strikes are anti-labor and anti-social, and as such are indefensible," Walter P. Reuther, President of the United Automobile Workers, CIO, writes in the current issue of the UAW-CIO newspaper.

John P. Frey, President of the AFL Metal Trades Department, pushed through machinery for settling Metal Trades Union squabbles at the last convention. Charles J. MacGowan, President of the Boilermakers and Jurisdictional Committee chairman, branded inter-union strikes as "breaches of faith and a violation of contracts with employers." He added, "No one among us would attempt to justify jurisdictional work suspensions."

Murray Sets Example

CIO President Philip Murray had an eye on Congress when he urged CIO unions to take it easy "go slow" and exhaust all possibilities of collective bargaining before striking. He set an example by agreeing to an extension of the contract with U. S. Steel Corp. from Feb. 15 until April 30.

▸ This move by the steel workers union, backed by the CIO automobile and electrical workers, should assure continued production.

▸ Murray admitted to AMERICAN MACHINIST that he hoped the current CIO disposition to avoid strikes would influence Congress itself to pass less restrictive legislation.

Portal Thinking Differs

The Senate and the House are taking two different approaches to the portal-to-portal pay problem.

▸ The Wiley and Capehart bills in the Senate would redefine "work" under the wage-and-hour law so as to exclude time spent in non-productive activities.

▸ The Gwynne bill in the House, which fixes a one-year statute of limitations on wage claims of any kind, would remove the portal-to-portal pay cases from the jurisdiction of the courts.

By not seeking to amend the Wage-Hour Law, the Gwynne bill prevents the tacking on of other amendments, such as to raise the minimum wage or broaden its coverage.

Washington

SURPLUS DISPOSAL PROBE CONTINUES... HEARINGS DUE ON JOINT PROCUREMENT... JET CONTRACTORS REVEALED

Surplus Competition Noted

Congressmen who will serve on subcommittees which will continue the investigation of surplus property disposal told AMERICAN MACHINIST they are increasingly aware of WAA's offering of surplus machine tools at prices strongly competitive with current new production. These sources said it is time to reconsider the broad problem of the effect of surplus property disposal on production, on invested capital, and on employment. They warned, however, that they believe some industries are exaggerating damage done them by competitive surplus disposal. But all representations will receive full consideration.

Study Committee Named

The Congressional study of surplus disposal will be continued by a five-man subcommittee of the House Committee on Expenditures in Executive Departments: Chairman Ross Rizley (R., Okla.), W. J. Bryan Dorn (D., S. C.), Chet Holifield (D., Calif.), Mitchell Jenkins (R., Pa.), Melvin Snyder (R., W. Va.). Three-man sub-committee of equivalent committee in the Senate will be: Chairman Homer Ferguson (R., Mich.), Joseph R. McCarthy (R., Wis.), and Herbert R. O'Conor (D., Md.), former governor of Maryland. These committees will probably function separately, with close coordination of their agenda, and not as a single joint committee, as rumored.

Procurement Debunking Due

Claims of fabulous money savings through coordinated procurement as a result of proposed Army, Navy unification are due for some debunking. The services have already gone far in joint procurement, and will soon reach the practical maximum. Some influential wartime purchasing experts will tell Congress, before it acts on the unification bill, that Army and Navy need: (1) more smart, experienced negotiators—a dud purchaser can waste huge sums; (2) more know-how among manufacturers—recruited firms more than doubled the prices charged by experienced firms for some items; (3) and vastly important, an efficient inventorying organization which would know at all times what supplies and how much are in the operation theatres—when front commanders don't know where stuff is, they order more.

War Contracts Scanned

Some Army and Navy war contracts still in effect were negotiated secretly and on terms that might startle peacetime critics. Officials sometimes claim security as their reason for not talking about them. You will hear more about this from the war investigating committee.

Year-end Buying Hit

If you have something hard to sell the Army, try for June. That's when they rush to spend their money, which otherwise reverts to the Treasury. It's the law, and many critics think it ought to be changed, giving the Services a continuous revolving fund. Records show that Army last year bought types of goods it had been declaring surplus. Navy doesn't have the same problem, but does tend to pile up its buying at the close of the fiscal year.

Gas Turbines for Ships

The Elliott Company, Jeannette, Pa., is building a 3000 hp. gas turbine for the Maritime Commission, which will install it in a collier for test runs within the next few months. In addition, the Commission will get full data from Navy, whose Bureau of Ships has gas-turbine development contracts with several companies, probably including Westinghouse, De Laval, Allis Chalmers.

Tests on Powdered Coal

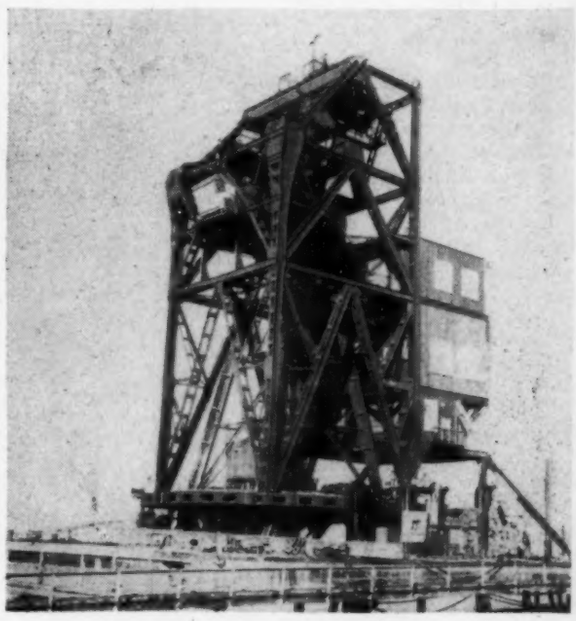
Johns Hopkins Locomotive Development Committee, supported by six railroads and bituminous coal industry, is designing a locomotive turbine to burn powdered coal. American Locomotive Company will test a 1/3 scale model soon, and Northrop-Hendy, at Fontana, Calif., will test a full-scale model. The Committee is confident of successful results. When it is through with locomotive tests, it wants to move into coal turbines for marine propulsion.

Coal burning prime movers are in a definite decline.

10 Hold Jet Contracts

AMERICAN MACHINIST obtained the following list of companies having development and production contracts with Army Air Forces and Navy Bureau of Aeronautics on jet propulsion devices, including turbo-jet, gas turbine-propeller, and ram-jet aircraft engines:

For AAF—General Electric, Wright Aeronautical, Menasco, and Northrop-Hendy. For Navy — Westinghouse, Allison Division of General Motors, Pratt & Whitney, Chrysler, De Laval, and Ranger Aircraft Engines. Air Forces confirmed the list, but Navy declined, saying it "looked pretty good." G. E. and Westinghouse are far in the lead, with Allison in third place. Old-line piston engine makers like Wright and Pratt-Whitney are trying to gain leadership in the jet field, which they didn't have time to accept during the war. British are far ahead with turbo-jets that run 200-250 hours before overhaul, compared with around 70 hr. in the U. S.



Self-Propelled Floating Crane — Recently acquired by the U. S. Navy Engineer Corps as part of the division of the German navy, this mammoth $3,000,000 hoisting machine is being reassembled on the West Coast. With a weight lifting capacity of 350 tons, the crane displaces 5,000 tons and has an overall height of 375 ft. The crane floats on rectangular pontoons, which are so wide its bumpers had to be removed to enable it to pass through the Panama Canal

Most of $2 to $5 Million Surplus Plants Go to Small Firms

DISPOSAL OF SURPLUS WAR PLANTS
Up to Oct. 28, 1946
(Plants Costing from $2-$5 Million)

Plant and Location	Total Cost	Sales Price	Purchaser
United Aircraft Willimantic, Conn.	2,886	1,750	American Screw Co.
General Electric Co. Fitchburg, Mass.	*4,551	2,300	General Electric Co.
Otis Elevator Harrison, N. J.	3,829	1,650	Otis, Zausner Food, Inc.
Buffalo Modification Center Buffalo, N. Y.	*2,460	783	Twin Coach Co.
General Motors Buffalo, N. Y.	3,071	2,550	General Motors
Symington-Gould Rochester, N. Y.	3,123	155	Bourjois, Inc.
Consolidated Vultee Allentown, Pa.	3,569	396	General Electric Hutt & Wasserman
Koppers Co. Baltimore, Md.	3,630	1,500	Koppers Co.
Ford Motor Co. Norfolk, Va.	2,135	1,610	Ford Motor Co.
General Motors Memphis, Tenn.	2,843	1,890	Kimberly-Clark
Bendix Aviation Chicago, Ill.	2,328	2,156	National Industries
General Motors Tilton City, Ill.	2,262	1,588	General Motors
Studebaker Corp. So. Bend, Ind.	4,387	2,100	U. S. Rubber Co.
Ordnance Steel Plant Bettendorf, Iowa	*3,622	1,200	Bettendorf Co.
Quad Cities Arsenal Bettendorf, Iowa	2,325	1,123	J. I. Case Co.
Chain Belt Co. Milwaukee, Wis.	2,106	1,422	Chain Belt Co.
Nash Kelvinator Kenosha, Wis.	4,202	1,237	Nash Kelvinator
American Propeller Co. Toledo, Ohio	3,749	1,600	Martin Parry Co.
Babcock & Wilcox Co. Alliance, Ohio	*3,445	1,316	Babcock & Wilcox Co.
National Cylinder Co. Cleveland, Ohio	*4,396	19 10	Snell Tool Co. Gibson Engr. Co.
Curtiss Wright Beaver Falls, Pa.	3,382	2,311	Westinghouse Electric
General Electric Erie, Pa.	2,196	1,529	General Electric
Ex-Cello Corp. Detroit, Mich.	*3,387	1,574	Ex-Cello Corp.
Nash Kelvinator Lansing, Mich.	2,718	1,138	Motor Wheel Co.
General Motors Flint, Mich.	4,285	2,126	General Motors
General Motors Bedford, Ind.	2,766	1,100	General Motors
Reynolds Metal Co. Louisville, Ky.	2,137	1,470	Reynolds Metal Co.
Rohr Aircraft Chula Vista, Calif.	2,219	43 60	H. H. Johnson Kirk Brevitype Corp.
Wright Aeronautical Corp. E. Paterson, N. J.	4,017	900	Marcalus Mfg. Co.
Liberty Aircraft Prods. Farmingdale, N. Y.	2,520	1,366	Liberty Aircraft Prods.
Remington Rand Elmira, N. Y.	4,363	1,850	Remington Rand

Including equipment

WASHINGTON — Plants originally costing between two and five million dollars, which were sold or leased by the War Assets Administration up to Oct. 28, 1946, are described in the accompanying tables.

These lists are presented as of special interest to the metalworking industry. All of the plant purchasers or lessees are producing metal products of some kind. WAA has records of what the applicants intended at the time of acquisition to produce in the plants. However, these records were found unreliable as many of the operators changed their plans due to changing markets, materials availability, and other reasons.

Over half of the acquisitions are by war-time operators, who held options on the plants. Many plants are equipped with government-owned machinery and other facilities, which the operators can arrange to purchase on option or turn back to the owning agency. All of these plants are, however, new in the post-war economy and cater to new customers and rely on new supply sources.

Small concerns have received a majority of plant disposals with purchases and leases by so-called big business accounting for only 24% of dispositions. Most of the big business acquisitions are the plants costing more than $5 million, which could not be utilized by small operators. Not listed here, but on WAA records, are many plants costing less than two million which were sold or leased to firms in the metalworking industry.

Editor's note: Plants costing over $5 million were shown in the January 30, 1947 issue of American Machinist, *pages 122 and 123.*

Recent Surplus Declarations

WASHINGTON—25 war-time installations were recently added to the surplus declarations by War Assets Administration. They have not been classified or processed for disposition.

Among the installations of interest in the metalworking field are: *Bell Aircraft Corp.*, Wheatfield, N. Y.; *Electric Boat Co.*, Bayonne, N. J.; *Howard Aircraft Corp.*, St. Charles, Ill.; *Ingalls Shipbuilding Corp.*, Birmingham, Ala.; *Martin Dennis Co.*, Newark, N. J.; *Monsanto Chemical Co.*, Texas City, Texas; *Penn-Jersey Shipbuilding Corp.*, Camden, N. J.; and *Willamette Iron & Steel Corp.*, Portland, Ore.

COMMERCIAL LEASES UP TO OCT. 28, 1946

(Plants Costing from $2-$5 Million)

Plant	Lessee	Cost of Facilities	Term
General Motors Bristol, Conn.	General Motors	3,117	1 year
Otis Elevator Buffalo, N. Y.	Otis Elevator	2,714	1 year
SKF Industries Montgomery County, Pa.	Kellett Aircraft Corp.	4,153	5 years
Kings Mills Plant Kings Mills, Ohio	Electric Auto-Lite Co.	3,347	5 years
Kropp Forge Co. Chicago, Ill.	Kropp Forge Co.	2,539	5 years
Pullman Car Mfg. Co. Chicago, Ill.	General Motors	3,359	5 years
Canton Mfg. Co. Canton, Ohio	Canton Mfg. Co.	*3,102	5 years
Ohio Foundry Co. Lima, Ohio	Ohio Foundry Co.	3,728	3 years
Unitcast Corp. Toledo, Ohio	Unitcast Corp.	*3,821	5 years
Eaton Mfg. Co. Saginaw, Mich.	Gabriel Co.	*4,108	5 years
General Motors Flint, Mich.	General Motors	3,977	3 years
Timken Detroit Axle Co. Melvindale, Mich.	Timken Detroit Axle Co.	3,869	3 years
Timken Detroit Axle Co. Detroit Mich.	Timken Detroit Axle Co.	4,943	3 years
Aluminum Co. of America Kansas City, Mo.	Vende Co.	2,540	5 years
Continental Motors Dallas County, Texas	Seiberling Rubber Co.	2,054	5 years
Pacific Car & Foundry Renton, Wash.	Pacific Car & Foundry	*2,921	1 year
Lockheed Van Nuys, Calif.	Aviation Maintenance Corp.	*3,190	54 mos.

Including equipment

WAA Lists $3 Billion in Goods As New Disposal Program Begins

WASHINGTON—War Assets Administration launched its "Second Operational Program" Feb. 1. About $3 billion worth of capital and producer goods and some consumer goods are listed.

Included in the lists for disposal starting this month are:

Portable metalworking tools, pneumatic and electric, at fixed prices—$16 million.

Tubular steel cutting electrodes, competitive bids—$1 million.

Resistance welding equipment, mostly fixed prices—$4 million.

Arc welding machines — fixed prices—$2,365,669.

Consumable electrodes, welding rod and wire, fixed prices—$2,261,419.

Heat-treating furnaces, with exceptions, fixed prices and competitive bids—$12 million.

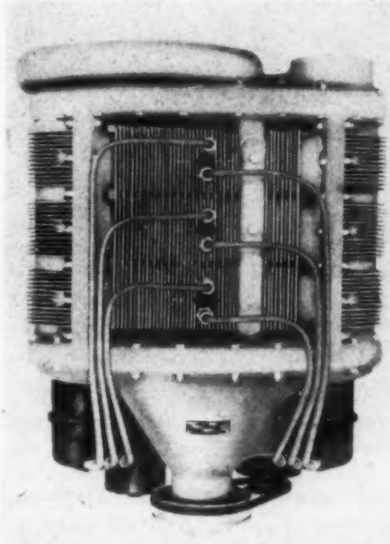
Abrasives, competitive bids—$54,436,000.

Production and automotive bearings, competitive bids—$23,105,000.

Cutting tools, competitive bids, $54,436,000.

Standard general-purpose machine tools, fixed prices—$5,550,000.

Tool steel, sealed bids—$7,500,000.



Opposed-Piston Principle Used Favorably on Gasoline Engine

LOS ANGELES—A 125-hp., 150-lb. opposed-piston gasoline engine for aircraft and marine use has been developed by McCulloch Motors Corp. and will be in production later this year. The engine has two crankshafts, no cylinder heads and uses fuel-injection nozzles. Aluminum-alloy die-castings are used, except for moving and wearing parts.

Applied successfully in Junkers diesels, the principle offers interesting possibilities for future gasoline engines. Advantages claimed include fuel economy equal to or greater than 4-cycle engines, lighter weight per horsepower than any engine in the power range, and easy servicing.

Valves Eliminated

The opposed-piston principle, in which two pistons operate against each other within the same cylinder, is especially suited to 2-cycle engines because good, unflow scavenging is possible without valves.

Near the end of the power stroke, each piston uncovers a ring of ports in its end of the cylinder, but gears connecting the two crankshafts time the pistons so one leads the other.

A gear-driven blower supplies air (not fuel mixture) which blows through the cylinder and out the exhaust ports until they close. Air continues to enter at slightly higher than atmospheric pressure until the intake ports are covered. This supercharging effect is offset because the volumetric efficiency is so reduced by the necessarily long scavenging period. Gasoline is injected as a liquid during the compression stroke and combustion is started with a sparkplug.

With a crankshaft along each side, 3 injection nozzles and 3 sparkplugs in the center, the 150-lb. engine develops 125 horsepower

Foreign Report

BASED UPON REPORTS FROM THE MCGRAW-HILL WORLD NEWS BUREAU

Postwar Projects Aid Australian Machine Tool Industry Recovery

MELBOURNE, AUSTRALIA—The Australian machine tool industry is slowly recovering from the stupor throttling production since the Jap surrender 16 months ago. The industry's animation is linked with gradual materialization of big postwar production projects in automotive, farm implement and electrical industries.

Despite an increase in capital equipment by more than 50,000 machine tools during the war years, most of them built in Australia, there is a marked shortage of certain special-purpose machine tools. Rehabilitation of permanent munitions factories and retooling of other government workshops have absorbed a substantial number of machines.

Australian machine tool makers employing more than 50 operatives now number 12, compared with two before the war and 200 (including a number of smaller outfits) at the peak of armament activity.

Production Costs Favorable

Although the industry is hampered by unrest in the metal trades and by dispersal of skilled workers to secondary mechanical industries, it can produce in many instances at prices which are at present below those of comparable types imported from the U. S. and Britain. Effect of the recent uppegging of wages remains to be seen.

▸ The highest Australian government authority on machine tools, aircraft and automotive industries believes no tariff changes are likely to be sanctioned which would encourage domestic machinery builders to compete with British and American special-purpose tool makers. Regardless of exchange considerations and pressure from disowned domestic tool makers, productive equipment for automotive and other industries would be imported where the best of it can be obtained.

China Awaits Jap Reparations

SHANGHAI — First shipments of reparations equipment from Japan are expected in China during March and will consist almost entirely of machine tools from a preliminary catalog of 25,000 prepared by the Supreme Commander for the Allied Powers.

Of these machine tools, 5,000 are listed as in "A" condition ready for immediate use, 12,000 in "B" condition, and 8,000 in "C" condition. Most of the latter group, fortunately for China, is 60-cycle powered and unusable with most power systems within China. The good equipment is generally 50-cycle.

New Plan Winning Support

Although a definite reparations program has been prepared by China, government officials, led by Wong Wen-hao, ex-minister of economic affairs and top industrial economist, are drifting toward supports of these principles:

▸ 1. Bulk of reparations to come from recurrent Japanese production.

▸ 2. Emphasis first on securing power-generating equipment. Power shortage precludes immediate use of even "A" class machinery until mid-1948.

▸ 3. Gradual acquisition of reparations over at least 10 years. After many months' negotiations, only $7.8 of equipment has been sold to 10 coal mines, six power plants and two machinery manufacturers of the National Resources Commission.

▸ 4. Tying of equipment acquisition into a definite industrial development plan, with the bulk coming in during the last five years.

▸ 5. Establishment of a reconstruction finance corporation. Biggest problem of putting reparations to work is financing purchase of plant sites, construction of factories, and installation of machinery. There are no sources of long-term, low-interest credit. Without sources of industrial capital, no amount of reparations will help China. There will be great heaps of idle machinery in coastal city warehouses.

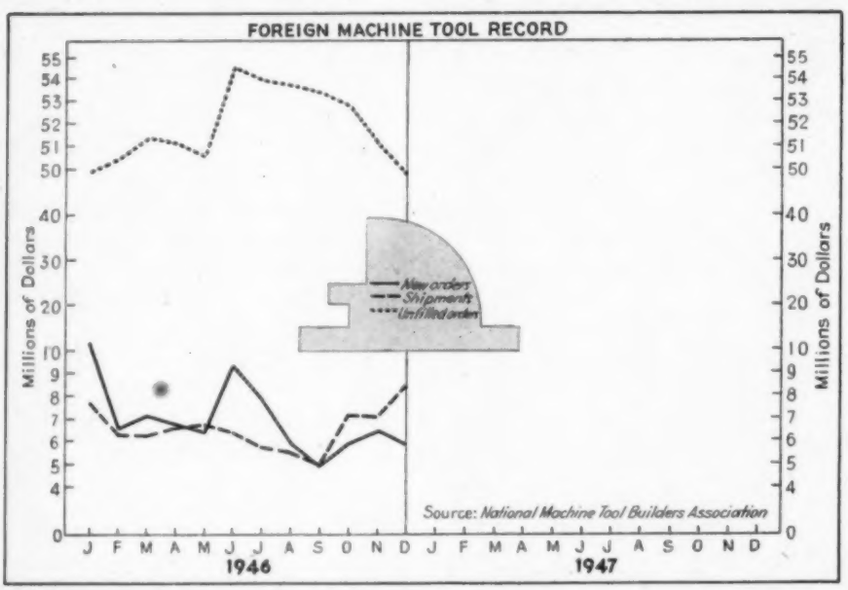
Shipments Handicapped

Limited Japanese port facilities handicap outward shipments. Main ports of Yokohama and Tokyo handled about 2 million tons of cargo in 1946. Full available tonnage of reparations material will run from 10 to 12 million tons, most of which must be moved through the Yokohama-Tokyo bottleneck.

French Progress on Aluminum

PARIS — In working aluminum, France is in some respects ahead of other countries, including the U. S. This conclusion emerges from extensive study of aluminum progress throughout the world over the past eight years published recently by Jean Guillemin, consulting aeronautical engineer, in the French "Revue de l'Aluminium."

In the field of bending open aluminum shapes, Guillemin considers the bender developed and constructed by Société des Avions Amiot as the most perfected so far in existence. On milling machines, Guillemin pays tribute to the advantage of direct fabrication, by spinning, of variable-section shapes, recently developed by Cegedur, a French fabricator.


FOREIGN MACHINE TOOL RECORD
Millions of Dollars
Millions of Dollars
New orders
Shipments
Unfilled orders
Source: National Machine Tool Builders Association
J F M A M J J A S O N D J F M A M J J A S O N D
1946
1947

Foreign Customers—Over 25% of last year's U. S. machine tool production was shipped abroad. Actual shipments totalled $78,521,494, or 26% of shipments by U. S. makers. Foreign firms placed $84,461,950 worth of new orders, or 27.5% of all orders placed in this country. At the end of December, a $48,121,295 foreign backlog was on the manufacturers' books. Cancellations, not shown above, totalled only $5,232,230 for the year

Names in the News

Howard W. Dunbar

Howard W. Dunbar, vice president and general manager of the Grinding Machine Div., Norton Co., Worcester, Mass. has retired. He joined Norton in 1913 as assistant chief engineer and subsequently became sales manager, assistant general sales manager, works manager and 15 years ago he was named general manager of the Grinding Machine Div. In 1938 he served as president of the National Machine Tool Builders Association and during the war he was assistant chief of the Tools Branch, W.P.B. He has been responsible for many new methods and improvements in the grinding and machine tool fields and will be retained by Norton as a consultant.

Robert W. Cornell has been elected a vice president of The Parker Appliance Co., Cleveland, Ohio and is now responsible for all manufacturing and related activities of the firm in Cleveland.

Harold A. Hallstein has been elected to the newly created post of executive vice president of The Austin Co., Cleveland, Ohio.

Walter D. Appel, former assistant to the vice president and director of engineering of Willys-Overland Motors, Inc., has been named chief engineer of the company.

Perry T. Egbert, vice president of American Locomotive Co., has been appointed to head all diesel-electric and steam locomotive activities for the company, including locomotive spare parts and marine and stationary diesel engines. His headquarters will be at the Schenectady, N. Y. locomotive plant. Also, **William S. Morris,** another vice president, has been placed in charge of Alco's other three divisions—Alco Products, Railway Steel Spring and the Canadian affiliate, Montreal Locomotive Works, Ltd. His headquarters will be in New York. Vice President **Norman C. Naylor** will direct and coordinate sales of all divisions with headquarters in New York. Also, **William A. Callison** was elected vice president in charge of western regional sales, while **William E. Corrigan** was named vice president in charge of eastern regional sales.

Reber C. Stupp, for the past four years manager of the three Dayton and two Cincinnati plants of the Delco Products Div., General Motors Corp., has been named vice president, director and production manager of Jack & Heintz Precision Industries, Cleveland.

Clarence G. Felix has been appointed works manager of the Cincinnati plants of the Crosley Div., Aviation Corp.

Everett M. Hicks has been appointed assistant manager of the Grinding Machine Div., Norton Co., Worcester, Mass. Also, **Oscar E. Nordstrom,** Chicago district manager of the division for 20 years, has retired. He has been succeeded by **Robert D. Lawson,** formerly sales representative for the division in northern New England. At the same time, **B. Harold Lewis** was named representative for the entire New England area except in western Mass. and Conn.

Sam Dansker has been appointed export sales manager of The Monarch Machine Tool Co., Sidney, Ohio, with headquarters in the New York office.

T. M. Dils has been appointed plants manager of Delco Products Div., General Motors Corp., Dayton, Ohio.

C. R. Abitz

E. M. Schultheis

Clarence R. Abitz has been appointed general manager of the McKees Rocks Works of the American-Fort Pitt Spring Div. of the H. K. Porter Co., Inc., Pittsburgh, Pa.

E. M. Schultheis, former manager of sales of the Automotive Div., Clark Equipment Co., Battle Creek, Mich., has been named manager of sales for the company. His appointment was coincidental with the retirement of **Edwin B. Ross,** vice president in charge of sales, and **Ezra W. Clark,** vice president and general manager of the Tructractor Div.

Robert S. Lynch, former vice president, has been named president of the Atlantic Steel Co., Atlanta, Ga. He succeeds **Charles F. Stone,** who has become chairman of the board. Also, **Wilbur F. Glenn** has been appointed vice president.

Charles S. Brown, former assistant purchasing agent of Ford Motor Co., has been named purchasing agent for the Lincoln Div.

Walter C. Weigle has been named Wisconsin representative of the Detroit Die Set Corp., with headquarters in Milwaukee.

C. A. Wiken

C. A. Wiken, for the past 8 years chief engineer of the Delta Manufacturing Div. in Milwaukee, has been promoted to the position of vice president in charge of engineering for the Rockwell Manufacturing Co., Pittsburgh, Pa. At the same time, **A. E. McIntyre,** for several years manager of the Nordstrom Valve Div. plant in Oakland, Calif., has been transferred to Pittsburgh as general manager of the company's Pittsburgh Equitable Meter Div.

W. F. Taylor, D. S. Kerr and **J. L. Pratt** have been named regional managers for Allis-Chalmers Mfg. Co., Milwaukee, Wis. Their territories are, respectively, the New England area, the southeast and the southwest areas. **A. J. Schmitz** will continue to direct activities in the Pacific area.

Ford Motor Co. has appointed the following men as plant managers of its new assembly plants: **A. R. Davis,** Los Angeles; **P. S. Mabie,** St. Louis; **R. J. Neville,** Metuchen, N. J.; and **Henry C. Dorsey,** Atlanta.

Stewart Walls has been named factory manager of the Eaton Manufacturing Company's Axle Div., and **C. C. Wickson** has become plant superintendent.

C. A. Pickering has been named manager of manufacturing; **Leland G. Atkinson,** works engineer; **Eric Perry,** superintendent of manufacturing; and **R. W. Scott,** sales manager of the newly acquired Beaver, Pa. plant for the Standard Control Div., Westinghouse Electric Corp.

T. I. Shriver retired Jan. 1 as board chairman of V&O Press Co., Hudson, N. Y. He formerly served as president and general manager.

BUSINESS ITEMS

The Fellows Gear Shaper Co., Springfield, Vt., has acquired the manufacturing rights to the plastic injection molding machine, formerly manufactured by the **Leominster Tool Co.,** Leominster, Mass., which will now be known as the Fellows-Leominster injection molding machine.

Monarch Machine Tool Co., Sidney, Ohio, has transferred its eastern sales office to 8113 Empire State Bldg., New York City.

The Cleveland Tapping Machine Co., formerly of Cleveland, has moved to its new plant at Hartville, Ohio.

Babcock & Wilcox Co. has purchased the Alliance, Ohio plant of **The Buffalo Weaving & Belting Co.,** Buffalo, N. Y. Babcock & Wilcox has also moved its Los Angeles office to the Petroleum Bldg., 714 W. Olympic Blvd.

The Lincoln Electric Co., Cleveland, has appointed the **Wallner Welding Supply Co.,** 303 E. South First Ave., East Duluth, Minn., as its dealer in Duluth.

General Electric Chemical Dept., Pittsfield, Mass., has established a plastics division and a compounds division to replace the former plastics divisions. **George F. Lehmann** and **John L. McMurphy** have been placed in charge of the respective divisions.

Ladish Drop Forge Co., Cudahy, Wis., has changed its corporate name to **Ladish Co.**

McCulloch Motors Corp. has moved its manufacturing facilities from Milwaukee to a newly completed factory at 6101 W. Century Blvd., Los Angeles.

The Weldon Tool Co., 3000 Woodhill Rd., Cleveland, has created a carbide form tool department.

American Steel Export Co., New York City, has been appointed exclusive export agent for their line of precision drilling equipment by the **Canedy - Otto Co.,** Chicago Heights, Ill.

The American Gear & Mfg. Co. 5900 Ogden Ave., Chicago, Ill., has been reorganized and incorporated with **Warren J. Kilburn** as president, **Maurice P. Collins,** vice president in charge of manufacturing, **John J. Rajnor,** vice president in charge of sales and advertising, and **Alan B. Gilbert,** vice president in charge of engineering.

Leonard C. Schmidt has organized his own engineering company at 3701 No. Broad St., Philadelphia, Pa. Mr. Schmidt was formerly with Edward G. Budd Mfg. Co., Peerless Steel Equipment Co., Day & Zimmerman, Inc., and during the war he served as chief industrial engineer in charge of production for the Jacobs Aircraft Engine Co., Pottstown, Pa.

Denison Engineering Co., Columbus, Ohio, has opened a Chicago branch office under the management of **Wyford D. Jones.** The office's territory includes Chicago and surrounding area—portions of Wisconsin, Illinois and Indiana.

DoAll Co. and **DoAll International Co.,** Milwaukee, have moved to new and larger quarters at 254 No. Laurel Ave., Des Plaines, Ill.

Savage Arms Corp., Utica, N. Y. is transferring its small arms manufacturing equipment from Utica to its **J. Stevens Arms Co.** plant at Chicopee Falls, Mass.

Cleveland Chain & Manufacturing Co., Cleveland, has acquired the **Woodhouse Chain Works,** Trenton, N. J. which it will operate as a division of the Cleveland firm.

Michigan Tool Co., Detroit, has appointed the **Anderson Machine Tool Co.,** 2641 University Ave., St. Paul, Minn., as its exclusive representative in Minnesota.

Lamson & Sessions Co., Cleveland, has established an Originating and Finishing Dept. which is a complete bolt and nut plant.

OBITUARIES

Frank P. Thediek, president of Sidney Machine Tool Co. and chairman of the board of the Monarch Machine Tool Co., Sidney, Ohio, passed away Jan. 18.

Claire L. Barnes, 66, president of Bendix Helicopter, Inc., Stratford, Conn., died Jan. 17. He retired while president of Houdaille-Hershey Corp., but three years ago helped in the formation of Bendix Helicopter and succeeded the late Vincent Bendix as president in 1945.

Eric H. Radford, 71, founder and former president of the Radford Steel Works, Los Angeles, died Dec. 25. He was one of the pioneers of the stainless steel industry on the Pacific Coast.

John A. Peyton, 48, owner of the Peyton Precision Tools Co., Los Angeles, died Dec. 29.

Ernest W. Pelton, 66, retired vice president and general manager of the Stanley Works, New Britain, Conn., passed away Jan. 16. He joined Stanley in 1903 and retired from active work in 1945.

R. Herbert Deyo, 83, founder the Deyo-Macey Engine Co. and the Larabee-Deyo Motor Truck Co., Binghamton, N. Y. died Jan. 23.

MEETINGS

American Management Association. Production meeting. Hotel Pennsylvania, New York, N. Y. April 14-15. Edward K. Moss, Director of Public Relations, 330 W. 42 St., New York 18, N. Y.

American Society for Testing Materials. Spring meeting and committee week. Benjamin Franklin Hotel, Philadelphia, Pa. Feb. 24-28. R. J. Painter, 1916 Race St., Philadelphia 3, Pa.

American Society of Mechanical Engineers. Spring meeting. The Mayo Hotel, Tulsa, Okla. March 2-5. Ernest Hartford, assistant secretary, 29 W. 39 St., New York, N. Y.

American Society of Tool Engineers. Annual convention. Houston, Texas. March 19-22. J. M. Cannon, director of public relations, 1666 Penobscot Bldg., Detroit 26, Mich.

Magnesium Association and U. S. Army Air Forces. Magnesium Exhibit. Wright Field, Dayton, Ohio. Feb. 18-20. T. W. Atkins, executive vice president, Magnesium Association, 30 Rockefeller Plaza, New York, N. Y.

National Ordnance Gage Conference. Lehigh University, Bethlehem, Pa. Feb. 13-14. Thomas T. Holme, chairman, Lehigh University, Bethlehem, Pa.

Society of Automotive Engineers. Spring Aeronautic meeting. Hotel New Yorker, New York, N. Y. April 9-11. Transportation meeting. Hotel Stevens, Chicago, Ill. April 16-18. John A. C. Warner, general manager, 29 W. 39 St., New York, N. Y.

Southern Machinery & Metals Exposition. 2nd annual exposition. Municipal Auditorium, Atlanta, Ga. April 14-17. R. S. Lynch, president, Atlantic Steel Co., Atlanta, Ga.

Western Metal Congress & Exposition. Oakland Civic Auditorium, Oakland, Calif. March 22-27. W. H. Eisenman, 7301 Euclid Ave., Cleveland 3, Ohio.

"Measuring at the Machine"

MINIMIZES PRODUCTION LOSSES!

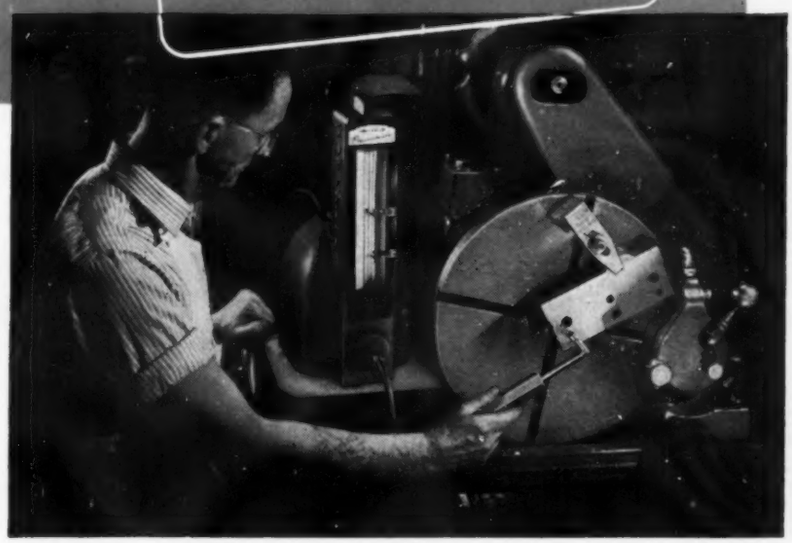
Reducing production LOSSES means reducing production COSTS. LOSSES usually occur at the machine—stopping such losses brings down costs.

"Measuring at the Machine" brings the following advantages which contribute to being able to sell a product profitably at or under competitive prices:

1. When accurate gaging is practiced right at the production machine, scrap losses have been reduced as much as 80% and 90%.
2. "Measuring at the machine" practically eliminates salvage work which is nearly always costly.
3. Component parts reaching the assembly line fit quickly and easily—no assembly time lost. Instead of working to the high limit as an operator normally does, he works to hit the part "on the nose."
4. When high production gaging instruments like the Multichek, Precisionaire and Visual Gage are used at the machine, the floor space devoted to inspection operations, gage maintenance costs and the labor cost of inspection are all greatly reduced.
5. Under close dimensional control, finished products give maximum performance, greater service life, and help build prestige for the manufacturer.
6. Fewer parts will wear out in service, and then replacement is quickly and easily done—no laborious fitting in the field will be necessary.

chek with Sheffield on "Measuring at the Machine"

1747



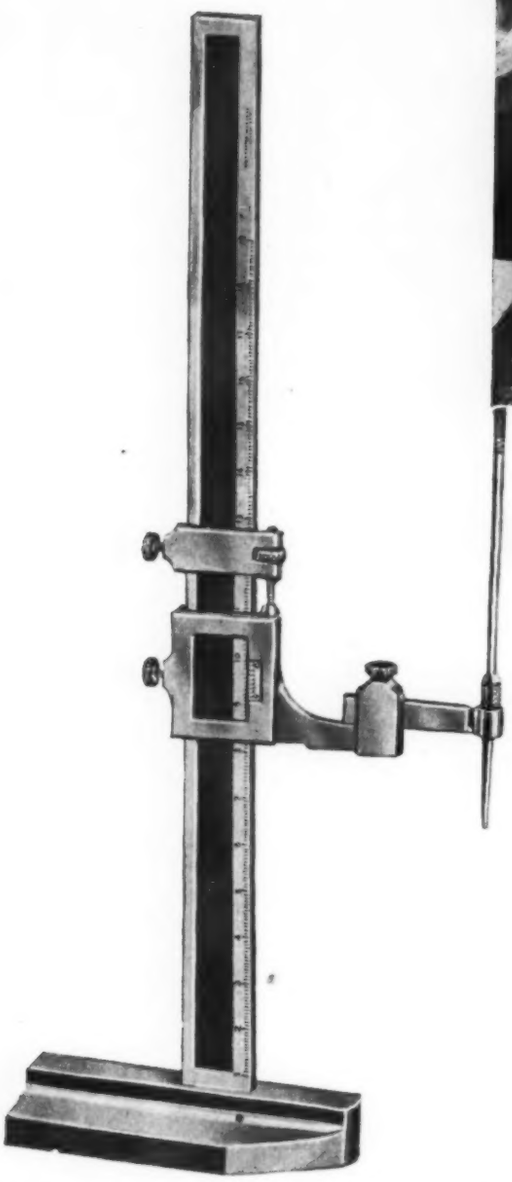
SHEFFIELD MASTER CRAFTSMEN

THE SHEFFIELD CORPORATION

Dayton 1, Ohio, U. S. A.

MACHINE TOOLS...GAGES
MEASURING INSTRUMENTS
CONTRACT SERVICES

TO COMPLETE THIS PICTURE



ADD THE RIGHT STARRETT TOOL

Add a Starrett Vernier Height Gage to the photo above and you have a picture that is familiar wherever fine precision work is done. Starrett Tools inspire the confidence of those who use them — help them make the most of their skill and experience. That's why it pays to insist upon *Starrett Tools* for all important measuring and inspection jobs. Be sure to specify *Starrett* when you requisition precision measuring tools.

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STARRETT

PRECISION TOOLS • DIAL INDICATORS • STEEL TAPES • GROUND FLAT STOCK
HACKSAWS • BAND SAWS FOR CUTTING METAL, WOOD, PLASTICS

STARRETT TOOLS

Minimum Physical Properties of R.W.M.A. Alloys

COURTESY OF RESISTANCE WELDER MANUFACTURERS ASSOCIATION

GROUP A COPPER BASE ALLOYS

Alloy	Proportional Limit Tension, psi.	Rockwell Hardness	Conductivity % I.A.C.S.	Ultimate Tensile Strength, psi.	Elongation % in 2 in.
Rod up to 1 in. in diameter					
Class 1	20,000	65R_b	80%	60,000	20%
Class 2	35,000	75R_b	75%	65,000	15%
Class 3	50,000	90R_b	45%	100,000	10%
Rod 1 to 2 in. diameter					
Class 1	17,500	60R_b	80%	55,000	25%
Class 2	30,000	70R_b	75%	60,000	15%
Class 3	50,000	90R_b	45%	100,000	10%
Rod 2 to 3 in. diameter					
Class 1	15,000	55R_b	80%	50,000	25%
Class 2	25,000	65R_b	75%	55,000	15%
Class 3	50,000	90R_b	45%	100,000	10%
Castings (All)					
Class 2	20,000	55R_b	70%	45,000	12%
Class 3	45,000	90R_b	45%	85,000	10%
Class 4 Alloys					
Cast	60,000	33R_C	18%	90,000	1%
Wrought	85,000	33R_C	20%	140,000	2%
Class 5 Alloys					
Cast	12,000-16,000	65R_b-85R_b	10-15%	65,000-75,000	10-2%
Square, Rectangular & Hexagonal Bar Stock up to 1 in.					
Class 1	20,000	55R_b	80%	60,000	20%
Class 2	35,000	70R_b	75%	65,000	15%
Class 3	50,000	90R_b	45%	100,000	10%
Square, Rectangular & Hexagonal Bar Stock Over 1 in.					
Class 1	15,000	50R_b	80%	50,000	25%
Class 2	25,000	65R_b	75%	55,000	15%
Class 3	50,000	90R_b	45%	100,000	10%
Forgings up to 1 in. thickness					
Class 1	20,000	55R_b	80%	60,000	20%
Class 2	35,000	72R_b	75%	65,000	15%
Class 3	50,000	90R_b	45%	100,000	10%
Forgings 1 to 2 in. thickness					
Class 1	15,000	50R_b	80%	50,000	25%
Class 2	30,000	70R_b	75%	55,000	15%
Class 3	50,000	90R_b	45%	100,000	10%
Forgings over 2 in. thickness					
Class 1	15,000	50R_b	80%	50,000	25%
Class 2	25,000	65R_b	75%	55,000	15%
Class 3	50,000	90R_b	45%	100,000	10%

GROUP B COPPER-TUNGSTEN ALLOYS

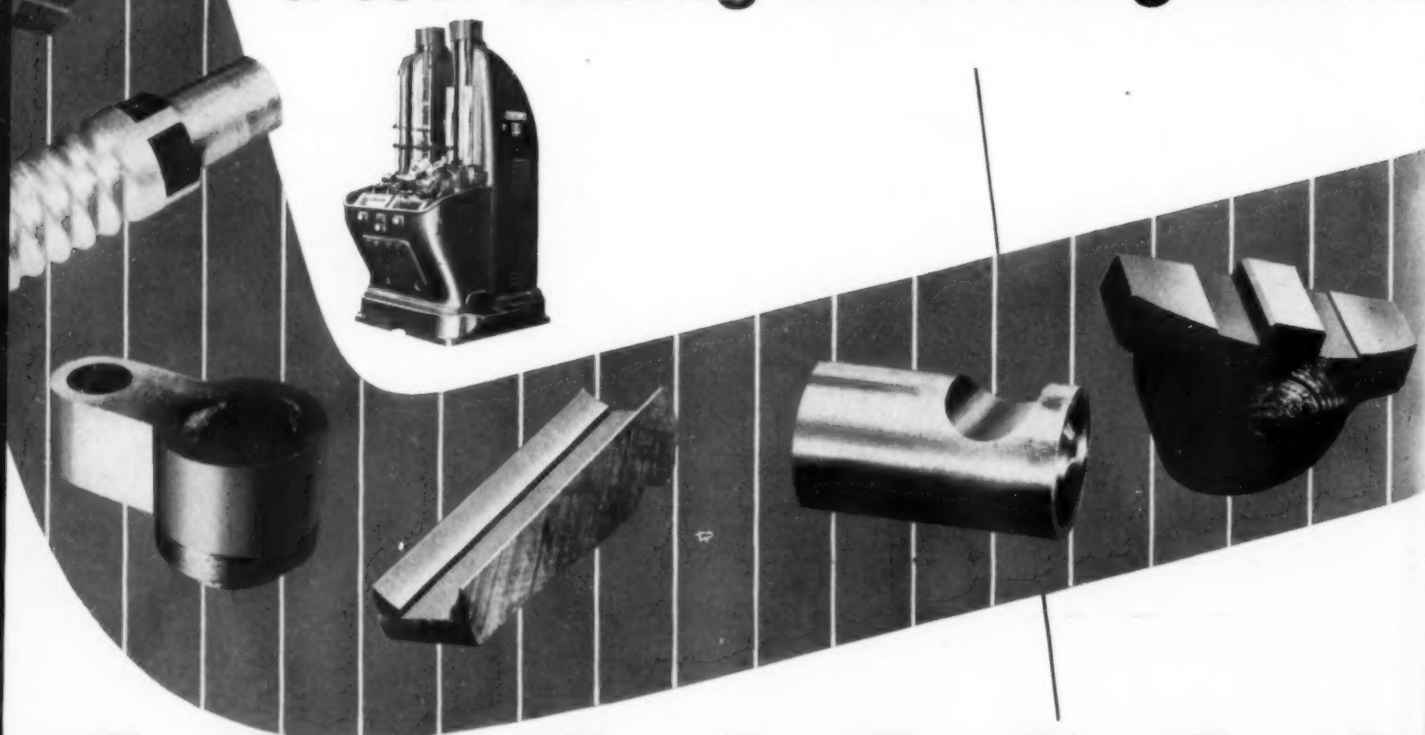
(Rods, Bars and Inserts)

Alloy	Rockwell Hardness	Conductivity % I.A.C.S.	Ultimate Compressive Strength, psi.
Class 10	72R_b	35%	135,000
Class 11	94R_b	28%	160,000
Class 12	98R_b	27%	170,000
Class 13	76R_a	30%	200,000

Footburt surface broaching has provided the means of reducing costs on many odd shaped parts that are difficult to machine in large quantities by other methods. Each application is individually engineered with rapidly operated fixtures for easy loading and with broaches designed to take full advantage of the capacity of the machine. We will be glad to study your machining problem and make recommendation on the application of Footburt surface broaching. Send blueprints and hourly production requirements.

THE FOOTE-BURT COMPANY • Cleveland 8, Ohio
Detroit Office: General Motors Building

a cost cutting machining metho



Footburt Patented Tooth For

FOOTBURT *Surface Broaching*

Comparable Alloys for Resistance-Welder Electrodes

THE RESISTANCE WELDER Manufacturers Association has recently revised a compilation of comparable tradenamed electrode alloys (table below) and the specifications covering minimum physical properties of electrode materials for resistance welders (see accompanying page). Recommended applications of these alloys, based on use with proper equipment, are:

Group A Copper-Base Alloys

CLASS 1

This is an all-purpose electrode material and superior to copper. It is especially recommended for use on coated metals such as terneplate, galvanized stock, scaly work, aluminum and aluminum alloys—used as spotwelding electrodes, seam-welder electrodes and seam-welder shafts.

CLASS 2

This is a superior electrode material for high-production work on clean carbon steel, some aluminum alloys and yellow brass. (It is used for spot-welding electrodes, seam-welder electrodes and seam-welder shafts. In cast form, Class 2 material provides high strength with high conductivity in applications such as gun-welder arms.

CLASS 3

There are several uses for this material: all projection, flash and butt welding electrodes; spot and seam welding of stainless steel, and current carrying bushings. The material is also cast where greater strength than provided by Class 2 is required.

Group B Copper-Tungsten Alloys

CLASS 10

This grade is recommended for spot welding of stainless steel and yellow brass, but not red brass and copper.

CLASS 11

Recommendations for this material include inserts and facings for flash-welding electrodes, also electrodes for light projection welding and seam-welder bushing inserts. Facings for electro-forging electrodes are also made of this material.

CLASS 12

This grade is used for heavy projection-welding electrodes and upsetting of rivets.

CLASS 13

Spot-welding electrodes and cross-wire electrodes for red brass, copper and the like are made of this material.

Supplier	GROUP A COPPER-BASE ALLOYS					GROUP B COPPER-TUNGSTEN ALLOYS			
	Class 1	Class 2	Class 3	Class 4	Class 5	Class 10	Class 11	Class 12	Class 13
AMPCO	Ampcoloy 99	Ampcoloy 97	Ampcoloy 95	Ampcoloy 86-20	Ampcoloy 92	Ampcoloy 3W1	Ampcoloy 3W10	Ampcoloy 3W20	Ampcoloy W100
COMMERCE PATTERN	Elkaloy A	Mallory 3	Mallory 100	Mallory 73	Commerce H	Elkonite 1W3	Elkonite 10W3	Elkonite 20W3	Elkonite 100W
ELECTROLOY	Electroloy A	Electroloy XX	Electroloy TX	Electroloy B	Electroloy Molin-2	Electroloy 1	Electroloy 10	Electroloy 20	Electroloy 100
MALLORY	Elkaloy A	Mallory 3	Mallory 100	Mallory 73	Elkaloy D	Elkonite 1W3	Elkonite 10W3	Elkonite 20W3	Elkonite 100W
S-M-S	Alloy 101	Alloy 103	Alloy W-5	Alloy W-2	Alloy 116	Alloy 1	Alloy 10	Alloy 20	Alloy 100W
WEIGER WEED	WW-1	WW-2	WW-3	WW-7	WW-8	WW-1W3	WW-10W3	WW-20W3	WW-100W
WELDING SALES TIPALOY	Tuffaloy 88	Tuffaloy 77 Tipaloy 130	Tuffaloy 55 Tipaloy 200	Tuffaloy 44	Tuffaloy 66	Tuffaloy 1W3	Tuffaloy 10W3	Tuffaloy 20W3	Tuffaloy 100W
AVAILABILITY	Bars Forgings	Bars Forgings Castings	Bars Forgings Castings	Bars Forgings Castings	Castings	Bars Inserts	Bars Inserts	Bars Inserts	Bars Inserts

Shipped to you in 8 hours!

When you need standard stainless steel bars, remember that your nearest Armco Distributor can usually ship your order from his stockroom the same day it is received.

Even when you want special shapes or grades, your order can be filled quickly through Armco's Rustless Division. More than 60 standard and special grades of bar and wire are rolling from Armco's mills.

IS THIS THE ANSWER?

If you have never used stainless bars or wire, would they make your products more efficient or more salable? Consider the excellent corrosion resistance of ARMCO Stainless bars and wire; their high tensile and yield strengths; their scaling resistance and high creep strength at elevated temperatures; their long service life and handsome appearance.

Whatever products or parts you make, stainless steel may be the way to greater sales and higher profits.

20-YEAR SPECIALISTS

Armco Distributors can offer you the help of our 20-year backlog of experience in the production of Stainless Steels. Research engineers of our Rustless Division have closely studied machining practices and investigated cutting rates, tool materials, lubricants, and other fabricating problems.

You can get the benefit of this experience — plus quick action on your orders — by calling or writing your nearest ARMCO Stainless Bar and Wire Distributor. If you do not know him, wire or write the Rustless Division, The American Rolling Mill Company, 3406 E. Chase Street, Baltimore, Maryland.

The American Rolling Mill Company • Middletown, Ohio

Rustless Division of ARMCO

Look First to ARMCO for Stainless Steel Bars and Wire

American Machinist REFERENCE BOOK SHEET

Chart for Dimensioning Strap Clamps

BY PAUL H. WINTER, CHIEF ENGINEER, LA SALLE ENGINEERING COMPANY

IN DESIGNING strap clamps, it is desirable to make the stud and the strap of approximately equal strength. A convenient way of doing this is to make the strap width equal to the diameter of the U. S. standard washer used with the stud, and then to select a strap thickness T suitable to the span L between the clamping point and the heel pin.

The accompanying chart was calculated for the condition where the stud is centrally located in the clamp and the slot is made with a standard end mill one size larger than the stud. To use the chart, first select the proper stud size for the clamping pressure (see table). This is based on a fiber stress of 8000 psi. in the stud, giving an ample safety factor.

Example: clamping pressure 400 lb.; stud size, ½-13 NC; span, 8 in. By reading up from span $L = 8$ on chart to curve for ½ in. stud and thence left, it is seen that a thickness of 1¾ in. is required. Ordinarily, the thickness is read to the nearest ¼ in.

If the stud is offset from the clamp centerline, the stud size and the thickness of the clamp will be affected. To select the proper stud size use the formula:

$$P_o = P \times \frac{L}{2d}$$

Where:

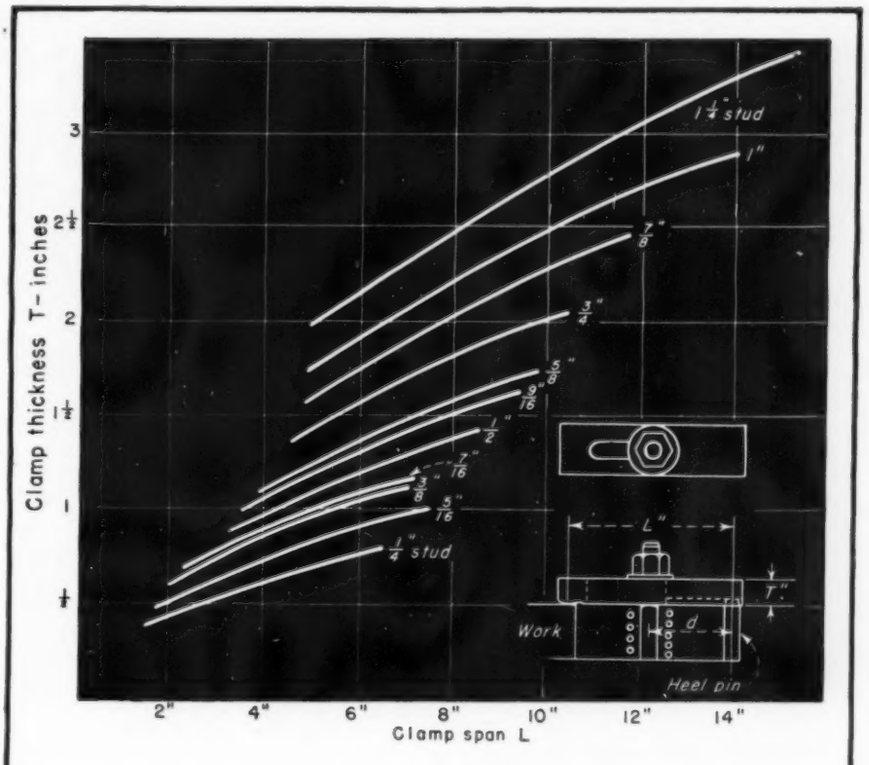
- P_o = equivalent pressure for use with chart to determine stud diameter
- P = actual clamping pressure
- L = actual span
- d = distance from stud to heel pin.

Example: $P = 400$ lb., $L = 8$ and $d = 2$. Then $P_o = 800$. From table, it will be seen that a ⅝—11 NC stud will suffice for this situation.

But T is affected by the offset position of the stud and is found by taking L as twice the distance from stud to heel pin, or stud to clamping point, whichever is larger. In this case $L = 8 - 2 \times 2 = 12$ in. To find T, read up from span $L = 12$ to the curve (extended) for a ⅝-in. stud and across to left, where it is seen that $T = 1¾$ in., approximately.

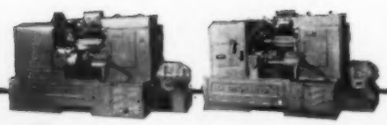
Stud Size Selection

Clamping Pressure Required, Lb.	Stud Size NC Thread
Under 100	¼—20
110—185	5/16—18
185—275	⅜—16
275—375	7/16—14
375—500	½—13
500—650	9/16—12
650—800	⅝—11
800—1200	¾—10
1200—1675	⅞— 9
1675—2250	1— 8
2250—3550	1¼— 7

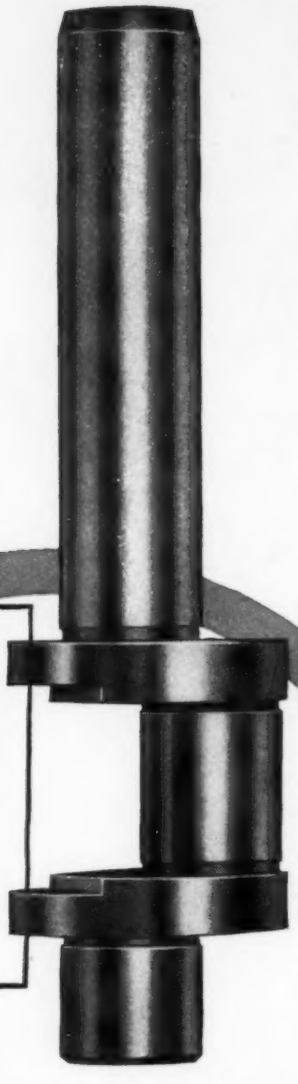


CLAMP DIMENSIONS

STUD	¼	5/16	⅜	7/16	½	9/16	⅝	¾	⅞	1	1¼
SLOT	5/16	⅜	7/16	½	9/16	⅝	¾	⅞	1	1⅛	1½
WIDTH	¾	⅞	1	1¼	1⅜	1½	1¾	2	2¼	2½	3



2 MACHINES INSTEAD OF 4



THE crankshaft illustrated (full size) is produced by a leading manufacturer and is typical of scores of such parts being turned out throughout the nation. The accepted procedure is to cut bar stock to length on a cut-off machine, and perform the other operations on three chucking machines . . . a relatively slow, costly procedure.

New Britain engineers proposed a complete departure: The long end is turned and the short end formed on a New Britain Six-Spindle Automatic Screw Machine. All the remaining cuts are accomplished on one New Britain Six-Spindle Automatic Chucking Machine. The same number of cuts — the same finish — with two machines instead of four. The savings in time, labor and machines are spectacular.

Lower production costs are the one key to more sales, more jobs, more prosperity. New Britain Machines and progressive New Britain research and engineering have teamed to make *New Britain* a by-word for *production* since the earliest days of modern machine tools. They stand ready to serve you and your business.

New Britain
Automatics

THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN-GRIDLEY MACHINE DIVISION
NEW BRITAIN, CONNECTICUT

ENGINEERING DETAILS

With the use of eccentric collets, the shank end and out-board support diameter are turned to grinding size and the piece cut off.

On the second operation, on a New Britain tooled as a chucker, and again using eccentric collets, the crank pin diameter is formed and the two shoulders of the crank shaft throw are faced.

Previous experience in machining this part revealed that the throws of the crank pin had a tendency to spread when the metal was removed. This difficulty is overcome by forming in successive steps down to the crank pin diameter and finally taking a light finish facing cut on each throw of the crankshaft. Parallelism between the center lines of both ends of the main shaft and the crank pin are thus held within the desired tolerance.

M-01053

Shop Equipment News

Kaukauna Portable Drilling Machine Will Drill, Tap Work at Any Angle

The operations performed by conventional radial and horizontal drilling and tapping machines are combined in the series 125 portable universal drilling and tapping machines built by Kaukauna Machine Corp., Kaukauna, Wis. It is possible to drill and tap at any angle in any plane within the limits of travel of the machine units.

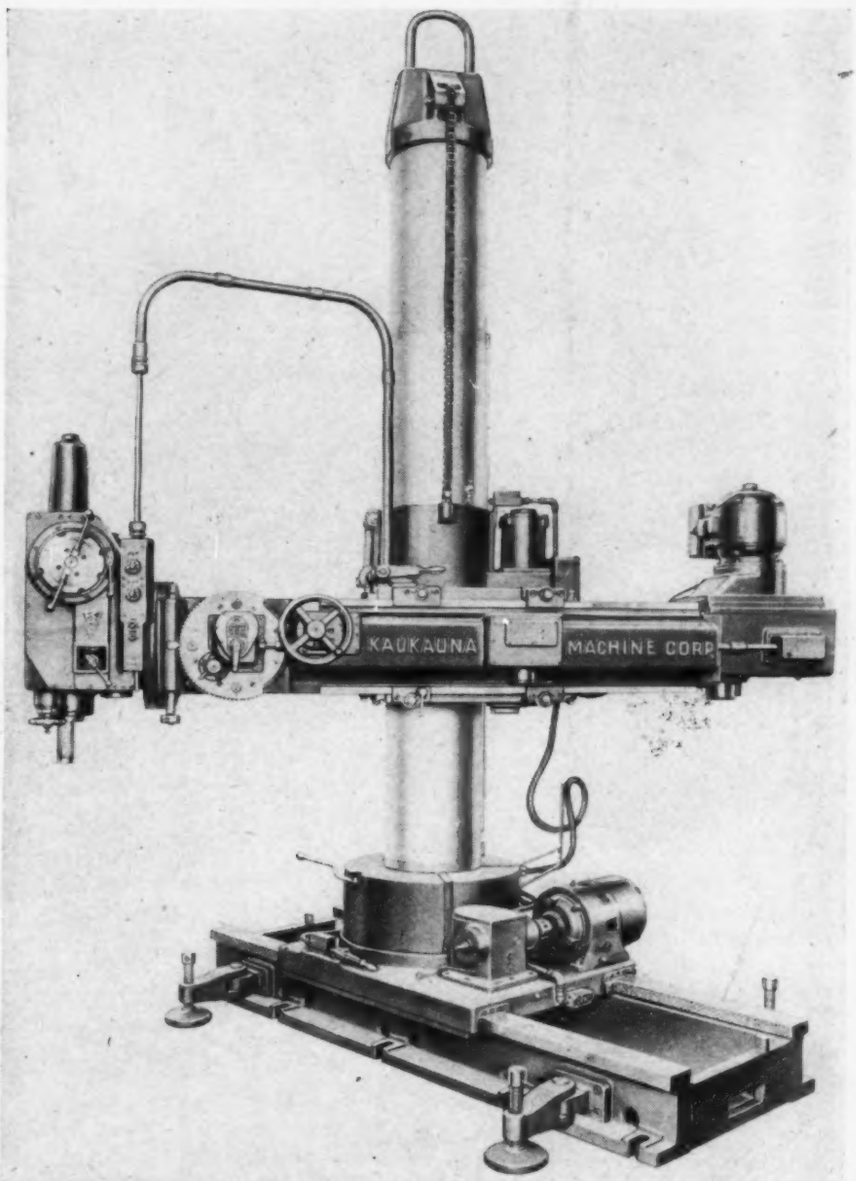
The head swivels 360° in either the horizontal or vertical plane. This is accomplished by positioning the headstock so it swivels 360°on a trunnion which swivels 180° in the vertical plane. The spindle has 12-in. continuous travel. The two rails which support the head and trunnion have a 24-in. horizontal traverse. Movement is through dual handwheels with dual hand-clamps locking the rails into position.

The rails may be raised or lowered by power and may be positioned at any point around the machine, swiveling 360°. Work is held on a model 700 indexing table on which it can be rotated to increase the versatility of the machine.

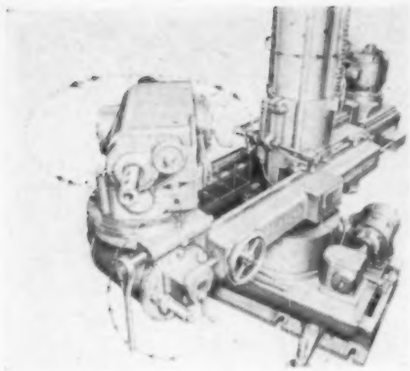
The column is supported on a traveling column base which has a 48-in. power travel. Spindle movement of 36 in. radially from the center of the column can be obtained by combining the spindle travel and the horizontal travel of the head.

The spindle-speed unit, located at the opposite end of the rails from the head, encloses the speed gearing. Three spindle feeds are provided with a nine-speed gear change box for the drive to the spindle. The speed changes are selected by dual rotary selector levers with an indicating dial showing the speed engaged.

Electrical collector rings on the base are used to transfer power to the drive mounted on the rails to prevent cable interference when the column is rotated. A lifting bail is attached to the top of the column. Three models are included in the series. Model 125-U is the universal model, while 125-HR and 125-H are horizontal machines. The HR has the head mounted on the two horizontal



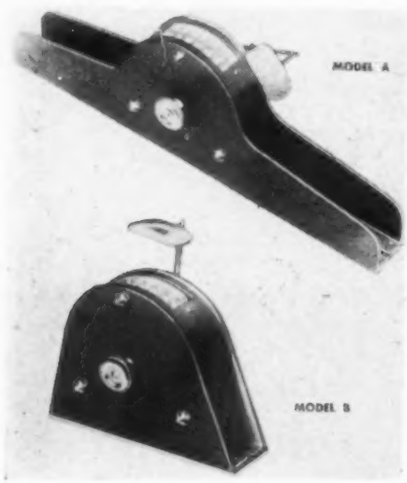
Kaukauna portable universal drilling and milling machine can be moved to bulky work and has flexible operating range



Arrows indicate direction and amount of rotation possible in the universal model of the series

rails with 24-in. horizontal adjustment. Model H is more compact and has a smaller range of applications. It is suitable for lowering into small vessels.

Angle Gage for Machine Tools Improved by Engis Equip. Co.



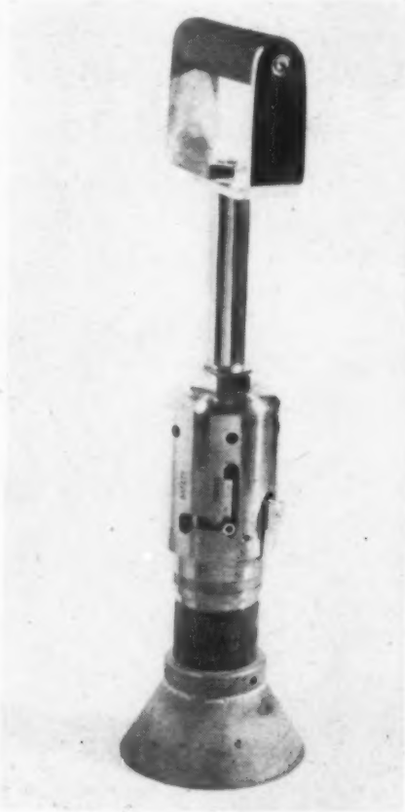
A Clinometer vernier angle gage is now available in two models with all-aluminum housing for lighter weight, a window for easier reading, and other improvements. It is manufactured by Engis Equipment Co., 431 S. Dearborn St., Chicago 5, Ill.

Action of the instrument is by a free-swinging drum graduated 360°. Inclination can be read from a pointer located above the drum. The reading is facilitated by a brake mechanism and by an attached magnifying glass.

The gage is used on various machine tools, including lathes, drill-presses and shapers.

Tempotool Drives Stud or Rivet By Power of Exploding Cartridge

A device developed during the war to patch the steel skin of battleships, has been legally ruled a tool rather than a dangerous weapon by Cleveland's law director. The Tempotool, produced by Tempotool Co., 3716 Clark Ave., S.W., Ohio, can be used to fasten 1½-in. steel plates to concrete or steel.



A cartridge is exploded to provide power for the operation. A flange on the stud or rivet projectile seals the firing chamber for an instant after the cartridge is exploded. The exploding charge is built up until the pressure causes the flange to shear off, after which the projectile travels down the two-inch barrel to the target. The cartridge is fired by forward pressure of a plunger when the end of the barrel is pressed against the work.

Arc and Oxygen Used for Cutting With Arcos New "Oxyarc" Process

A method for hand cutting or piercing stainless and stainless clad, alloy steel, aluminum, bronzes and brasses, cast iron, Monel, Inconel and nickel which combines an electric arc and a stream of oxygen is announced by Arcos Corp., 1515 Locust St., 402 Gulf Bldg., Philadelphia 2, Pa.

A specially designed holder is used with a tubular coated "Oxycuttend" rod which is consumed in the process of cutting. It can be used with either a dc. or ac. welder.

The arc is established between the rod and the metal to be cut, then the oxygen is supplied through the tube. Cutting is by a highly concentrated point of heat. The method is said to be particularly effective in cutting stainless steel and the nonferrous metals.

POWER SHEARS—A line of all-steel power squaring shears with capacities up to 14 gage has been introduced by Parker Manufacturing Co., 2200 Colorado Ave., Santa Monica, Calif. The shears have a low center of gravity, standing only 47 in. high, With a blade length of 75 in. they have a cutting length of 73 in. The shears have a 2 hp. motor and on 50- or 60-cycle current operate at 85 strokes per min.

"ONE LATHE GETS YOU TWO"...

IF IT'S A *DUOMATIC*

THE Lodge & Shipley Duomatics (multiple tool automatic lathes) are like TWO LATHES IN ONE . . . dual tool slides, front and rear, operate singly or simultaneously. With *two* multiple tool set-ups working, production may increase double or more. One noted truck manufacturer reports their 3-A Duomatic increased production of transmission mainshafts by 250%.

L & S Duomatics are versatile too, on large or small lots. An endless variety of parts are machined on the 2-A or 3-A Duomatic*—amazing lathe production experts—there are no change-overs and no cams.

This modern machining marvel actually takes over from the moment the unskilled operator loads the work-piece. The part is accurately duplicated without further attention from the operator, no matter how complex the job, performing any combination of straight or angular "in or out" turning and facing operations.

Write on your company letterhead for Bulletins 634 and 635 on the 2-A and 3-A Duomatics.

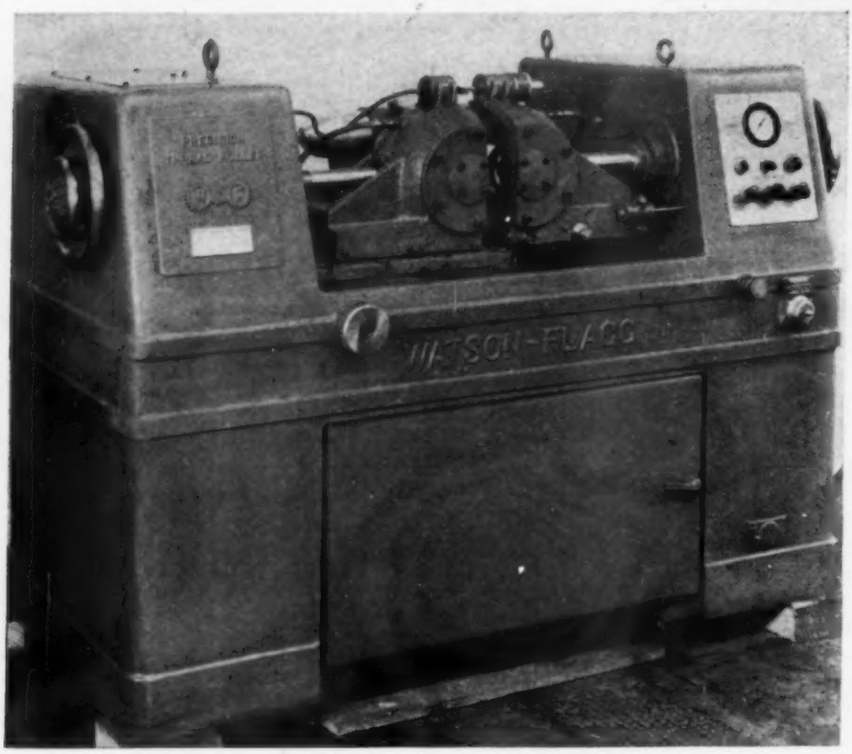
*The 2-A Duomatic is for small work, the 3-A Duomatic for larger jobs.

THE *LODGE & SHIPLEY* COMPANY

CINCINNATI 25, OHIO, U. S. A.

MACHINE TOOL DIVISION 3055 COLERAIN AVE. • SPECIAL PRODUCTS DIVISION 800 EVANS ST.

Watson-Flag Co. Thread Roller Designed to Produce Class 4 Fit



Watson-Flagg machine rolls threads to size as determined by the large micrometer mounted on top of the roll housings

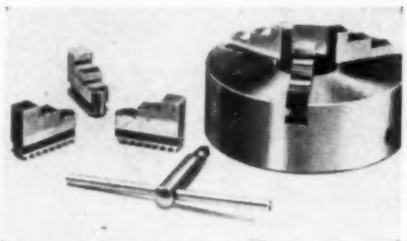
The model C precision thread roller announced by Watson-Flagg Machine Co., Paterson, N. J., is a redesigned machine developed from the model which, it is claimed, rolled threads during the war at less than 1/10th normal thread-cutting costs.

The roller is designed to give class-4 threads as long as the blanks are held to size. Thread accuracy is in the die rolls and not in the skill of the operator, who only loads and unloads. The thread size is repeated accurately, because the hydraulic rolling pressure continues until the piece reaches size, and a micrometer over the work causes the machine to knock off. The micrometer does not carry working loads.

With manual loading the machine has a rate of 600 pieces per hour when rolling larger sizes up to 2-in. dia., and 800 with sizes up to ⅝-in. dia. A loading fixture (not furnished) will increase the first figure to 800 and the second to 1500 pieces per hour. Work from 0.138 to 2½ in. with a thread length to 2¼ in. can be handled. Materials with elongation properties that permit flow without breaking are used. This includes steels (low- or high-carbon and alloy steels) up to 38 Rockwell C.

A wide variety of thread shapes can be rolled with the dies, which have a standard size 6-in. dia. and 2¼-in. face. The sliding action of the dies is claimed to burnish the thread surface, leaves no burrs, and work-harden the threads.

Falls Universal Lathe Chuck Has Hardened Alloy Pinions



A 5-in. universal 3-jaw lathe chuck with three hardened alloy pinions to reduce wear and eliminate search time has been announced by Falls Products Inc., 120 N. Genoa St., Genoa, Ill.

The Falls 5U 5-in. chuck is threaded to mount directly on lathes with 1½ in.-8 spindle threads and can also be adapted to others. Two sets of interchangeable jaws for internal and external grip are furnished.

Also available is a 6-in. independent 4-jaw chuck for 1½ in.-8 spindle thread mounting.

Acme-Danneman "Cent-A-Matic" Is for Lathe, Grinder Headstock

The "Cent-A-Matic," designed to be placed in the headstock of a lathe or cylindrical grinder, is distributed by Acme-Danneman Co. Inc., 203-205 Lafayette St., New York 12, N. Y. When used in a lathe, the Model 10 eliminates the use of a lathe dog. The Model 20 for grinders, is designed for grinding diameters to shoulders.

On both models the depth of center drill can vary as much as 3/32 in. Duplicate parts for plastic molds having shoulders can be turned or ground to exact length dimensions.

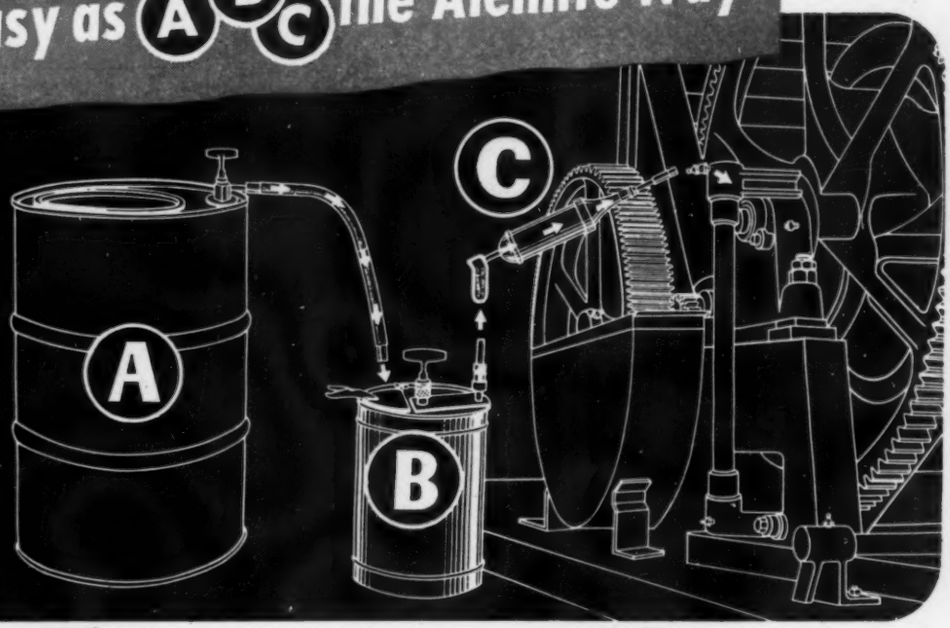
Tinius Olsen Wearometer Tests Walkway Materials

A machine for testing walkway materials, the Wearometer, is announced by Tinius Olsen Testing Machine Co., 599-C, N. 12th St., Philadelphia 23, Pa. Designed to determine surface resistance of wood, linoleum and leather, it can be used for testing plastics, laminates and paint surfaces. The Wearometer has a large steel disk upon which abrasive grain is distributed. The disk revolves at a uniform speed of approximately 23.5 rpm. The specimen is held in a holder connected to a vertical shaft which revolves at 32.5 rpm. The specimen is lifted and dropped twice in each revolution. The drop is 1/16 in. and 10 lb. deadweight provides uniform pressure.

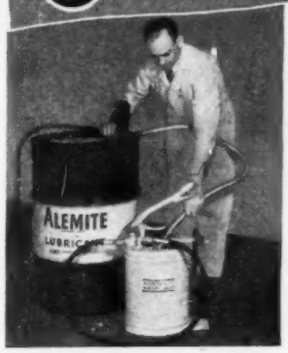
How to Handle Lubricants "FROM BARREL-TO-BEARING..."

It's as Easy as A B C the Alemite Way!

Handling Oils and Greases Need Not Be a Disagreeable and Messy Task



A Transferring



The Alemite Way, You Transfer Oils and Greases Quickly . . . Easily

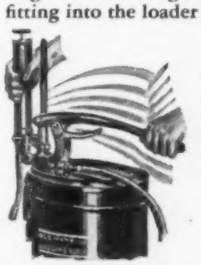
◀ Alemite air operated transfer pump filling Alemite volume pump and grease gun loader

Not even the oiler's hand touches the grease or oil. There's no mess, no waste, not the slightest chance for contamination. The transfer pump can be used to fill any piece of lubricating equipment faster and more easily direct from original drums.

B Loading

How You Load Grease Guns Full . . . without Mess or Waste

1. The Hand Gun has a special loader fitting. To fill the gun, simply insert the fitting into the loader valve on the pump. Then pump until the gun is full. No air pockets — a full gun every time.



2. You'll know when the gun is full. The loader valve automatically closes. The pump handle locks and you can't possibly overload the gun or damage the gun barrel. *And* there's no grease to be wiped off.

C Applying

New Alemite Hand Guns with Loader Fitting

Lever-Type Gun . . . a heavy duty gun with loader fitting mounted in the head. Gun is available in two models — No. 6679-E and No. 6243-E.

Push-Type Gun, the loader fitting mounted in the head. Available in two models — No. 7553 and No. 7584.

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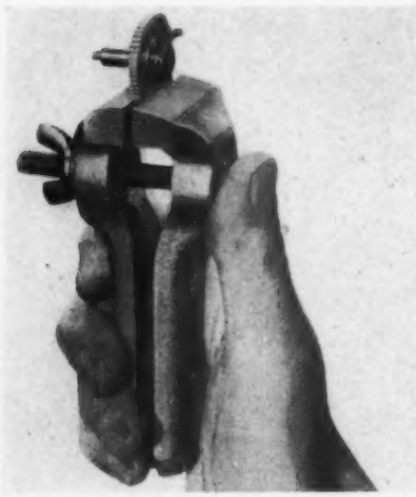
*Name*_____

*Address*_____

*City*_____ *State*_____

Another Product of STEWART WARNER

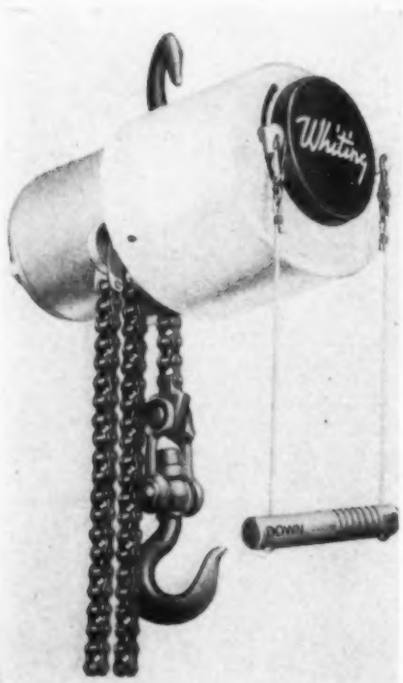
Palmgren Aluminum Hand Vise Weighs 7 Oz.; Opens 1½ In.



An aluminum hand vise for handling small parts is produced by the Chicago Tool & Engineering Co., 8383 S. Chicago Ave., Chicago 17, Ill. The vise, which weighs 7 oz., is 5 in. long and has 1½-in. jaws.

Opening to 1½ in., the jaw faces are machined to provide a true surface. The vise is known as Palmgren No. 15 hand vise.

Whiting Corp.'s One-Ton Hoist Has Weight of Only 87 Pounds



A line of ¼-, ½- and 1-ton capacity roller-chain electric hoists has been announced by Whiting Corp., Harvey, Ill. The one-ton hoist has a total weight of only 87 pounds.

The hoists utilize a totally enclosed, double-reduction, worm-gear drive. A self-energizing motor brake interlocks with the controller. Control is effected by one-hand operation of a single-bar grip. The hoist can be operated in an inverted position, with the work attached directly to the top of the hoist and the cable attached to the overhead suspension point.

Hill Radius-Grinding Fixture Grinds Side-Milling Cutters

The model B grinding fixture, which is designed to grind radius side-milling cutters to a true radius up to 180° of arc, has been announced by Hill Machine Co., 1032 Mulberry St., Rockford, Ill.

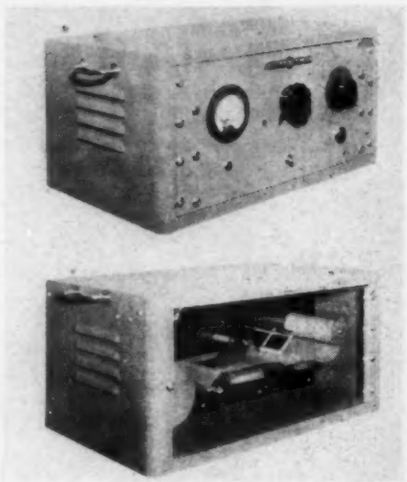
The fixture, which takes cutters up to 6-in. dia., is mounted on a standard grinder and holds the cutter so that the radius is ground by rotating the fixture spindle with the handwheel for each tooth of the cutter. The face of a straight grinding wheel is dressed parallel to the grinder table so that the entire face is used and grooving and repeated dressing can be avoided.

GE Instrument Detects Flaws In Wire and Thin Materials

A flaw detector to continuously detect and count holes, weak spots and conducting paths in thin materials such as paper, sheet rubber, plastic materials, varnished cloth and enamel films on wire has been developed by Apparatus Dept., General Electric Co., Schenectady, N. Y.

To be applied during manufacture, the detector is designed to handle sheet material to 0.25 in. thick moving up to 450 fpm. and wire moving 100 fpm.

The detector can be made to sound an alarm, shut down manufacture or indicate when flaws exceed a given total. It consists of an electrode assembly which applies an adjustable voltage to the material tested, and an electronic circuit to indicate the flow of current.



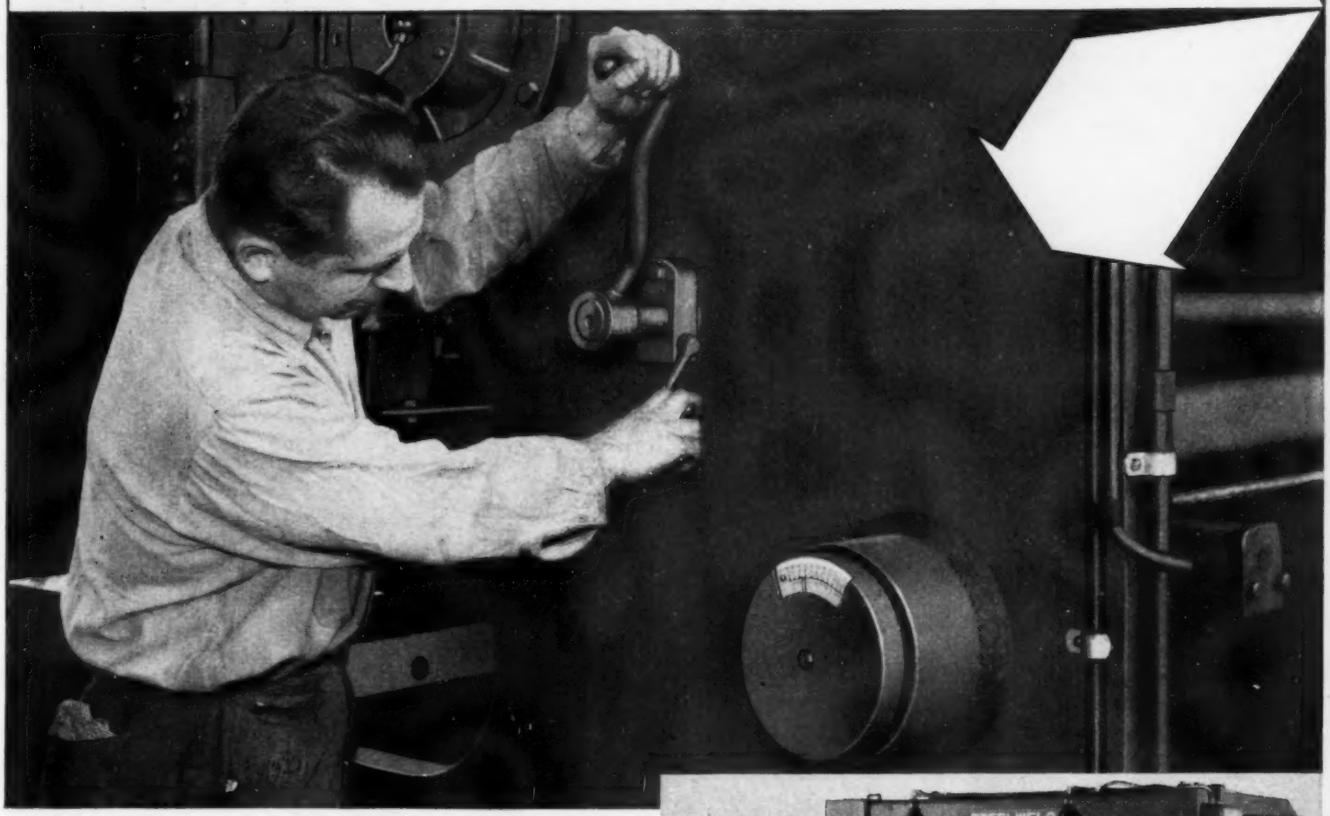
Atco Electric Lift Can Operate With Standard 11-Plate Battery

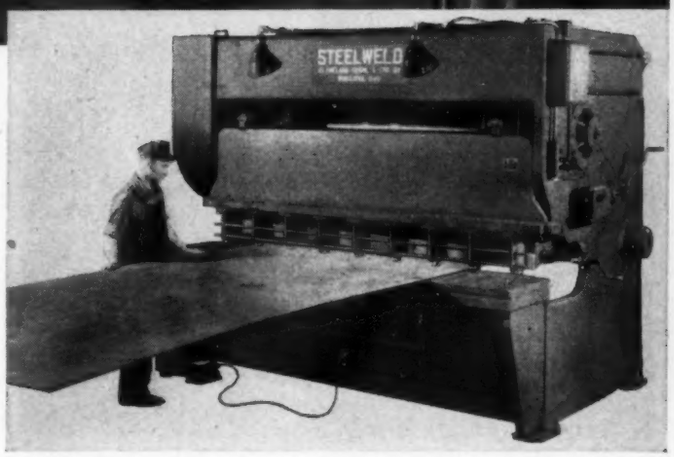
The 1947 model Transporter with the Atco electric lift, a hand-truck operating with a standard 11-plate battery, has been announced by Automatic Transportation Co., 149 W. 87th St., Chicago 20, Ill. All controls (forward, reverse, lift, steering, speed and brake) are arranged for one-hand regulation.

Also announced is the 1947 model Atco foot lift. Both the electric and foot-lift trucks come in 4000- and 6000-lb. capacity on pallet models.

The use of silicone varnish and grease for insulating and lubricating motors on fork and platform lift trucks has now been adopted by Automatic. Engineer tests report that silicone-insulated motors have run more than 5,000 hours at 300 C. without insulation failure.

KNIFE CLEARANCE *Easily Adjusted* FOR ANY THICKNESS . . . . .





THERE is a direct relation between thickness of plate cut and clearance between knives for most satisfactory results. To properly set this clearance when changing from one plate thickness to another has been made extremely simple in Steelweld Shears.

The need of moving the shear bed, adjusting various nuts, testing the knife clearance with feelers, etc., has been eliminated. Such bothersome, time-consuming work has been reduced to the mere turning of a convenient crank. A large dial indicator indicates the clearance in thousandths of an inch and also shows the plate thickness that may be cut for any knife setting. Because knife adjustment has been made so easy, operators willingly make it on Steelweld Shears and thereby get the best possible cuts for every plate thickness—and knives remain sharper for longer periods.

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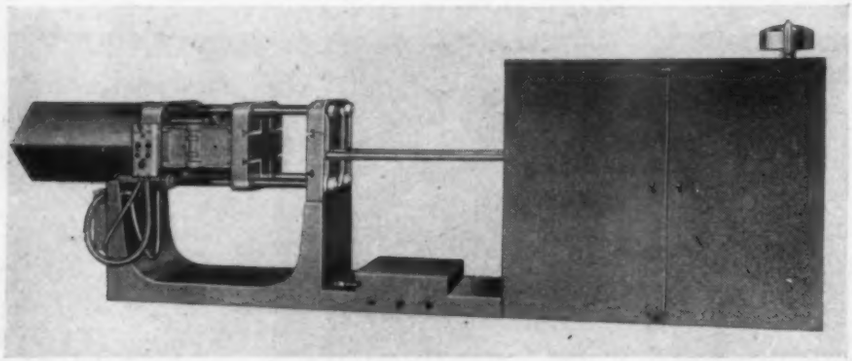
THE CLEVELAND CRANE & ENGINEERING CO.
1401 EAST 282nd ST. *WICKLIFFE, OHIO*

STEELWELD PIVOTED BLADE SHEARS

H. L. Harvill Die-Casting Machine Is High-Speed Cold-Chamber Type



Harvill cold-chamber die caster has a capacity for aluminum of 2.6 lb. and will handle proportionate amounts of magnesium or brass

The HD103 high-speed cold-chamber injection-type die-casting machine is now manufactured by H. L. Harvill Mfg. Co., Corona, Cal. The model has a center gate for cold chamber casting of aluminum, magnesium and brass alloys. Provision is made for conversion to hot-chamber operation for zinc, lead, and tin base alloys, which also may be cast as cold-chamber die castings.

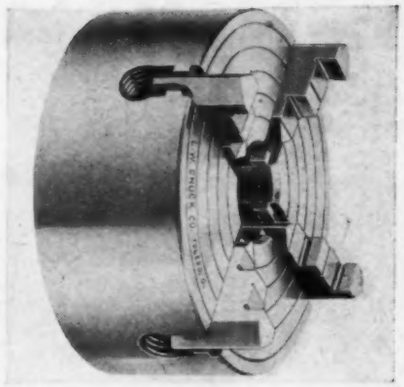
The machine has a maximum capacity for 2.6 lbs. of aluminum and a proportionate volume of other base metal alloys, and is said to have a maximum rate of 500 casting cycles per hour. It follows the basic Harvill design but is scaled down to make high-speed casting of small- to medium-sized parts.

Normal die dimensions are 13½ in. vertical by 23 in. horizontal, with 10 in. between dies when open and a maximum thickness of 19 in. when closed. The die platen size is 19 x 23 in. overall. Oversize dies may be used if the longest dimension is horizontal and the metal volume does not exceed the specified maximum.

The injection piston has a 13-in. stroke and 4-in. dia. It operates under 1000 psi. oil hydraulic pressure and provides a pressure of 5000 psi. on the metal. It is claimed that this pressure produces high-speed castings with high mechanical properties that are free of galling caused by the high-pressure forcing of metal into die-cavity surface irregularities.

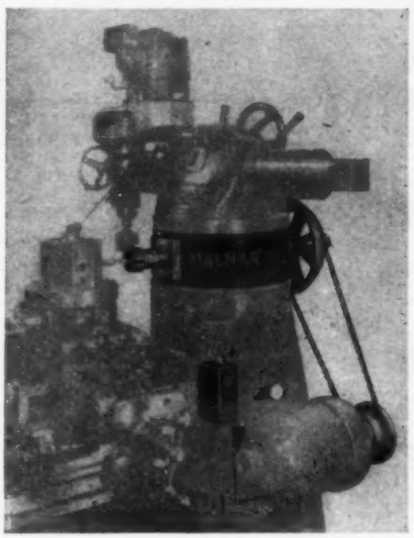
A pump driven by a 5-hp. electric motor supplies oil for the hydraulic system. The controls are semi-automatic with automatic time-cycle adjustments. There is a foot-switch injection control.

The hydraulic -mechanical locking device holds the dies closed under 100 tons pressure.



INDEPENDENT CHUCKS—8-in medium-duty and a 6-in. heavy-duty (shown above) 4-jaw independent chuck for small lathes are now made by L-W Chuck Co., 25 S. St. Clair St., Toledo, Ohio. The bodies are semi-steel castings, the jaws are steel with hardened and ground steps. Adapter backplates with 1½ in.-8 thread suitable for some Atlas, South Bend and Logan lathes are available

Malnar Horizontal Unit Makes Bridgeport Millers Universal



A permanent installation for Bridgeport turret milling machines has been developed by Malnar Machine & Tool Co., Inc., 19301 St. Clair Ave., Cleveland 10, Ohio. All jobs are done on one set-up: vertically by the Bridgeport and horizontally by the Malnar.

The Malnar is designed for heavy end-milling, fly-cutting, drilling and other operations. Spindle speed is from 125 to 3000 rpm.

Installation is claimed to be easy, and the Malnar is permanently centered on zero. When using it the Bridgeport is swung away.

Monarch "Air-Tracer" Follows Irregular Contours of Templet

For turning, boring and facing irregular contour work, an "Air-Tracer" is supplied by Monarch Machine Tool Co., Sidney, Ohio. Under an exclusive license from the Bailey Meter Co., Cleveland 10, Ohio, the attachment (previously known as the Bailey duplicating attachment) is available for new 14-, 16-, 18- or 20-in. Monarch toolmaker or engine lathes. Other applications will follow as the necessary engineering is completed.

The attachment, described in detail in this department last year, has an air tracer to follow the thin metal templet or model. Air loading pressure established by the position of the tracer controls the toolslide through a hydraulic relay valve.

Air Reduction Wires and Tapes Made for Automatic Arc-welding

A group of automatic arc-welding wires and tapes is announced by Air Reduction, 60 E. 42nd St., New York 17, N. Y. The line includes five knurled-type wires and five tapes all for flat position operation and all designed for low cost, uniform, automatic welding. They are manufactured in several diameters.

GEAR HIGHLIGHTS

VOL. XI NO. 1

This is page 1 of the current issue. Write for the complete issue today.

ALSO IN THIS ISSUE

Dynamometer Research... p. 2
New Gear Literature..... p. 3
No Divided Responsibility. p. 4

PACIFIC-WESTERN HANDLES CONE-DRIVE GEARING ON COAST

Cone-Drive gearing and Cone-Drive speed reducers, both standard and special, are now available to industry in eleven West Coast States directly through Western Gear Works and Pacific Gear and Tool Works.

Through this arrangement, Western Gear Works and Pacific Gear and Tool Works who have been engineering, manufacturing and distributing gear products and speed reducers on the Pacific Coast for over 50 years, make available not only their engineering skill and facilities on special installations but also quick delivery on the newly standardized Cone-Drive gear sets and speed reducers—newest and most striking developments in the gear field.

GEAR OUTPUT BOOSTED 200% per Machine by UNDERPASS Curve-Shaving

A 200% increase in output per gear finishing machine—brought about by combining underpass shaving and "curve-shaving"—is reported by a major motor vehicle manufacturer. The gear on which comparative runs were made was a cast iron timing gear for automobile engines, an 8 pitch 24 tooth type with a ⅞" face. Stock removal is approximately .004" to .006" over pins.

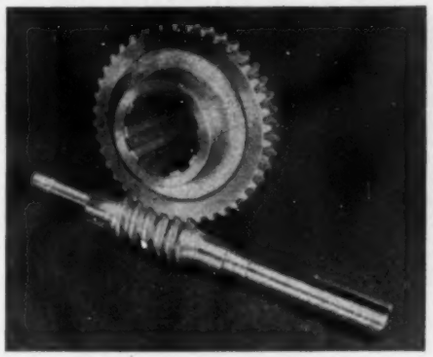
Originally about 36 gears were turned out per hour on each of the conventional gear finishers that used axial cutting reciprocation and a rocking action to relieve ends of gear teeth. The first Michigan Tool Company underpass curve-shaver installed upped the output to 110 gears per hour. Operating on the principle of tangential rather than in-feed of the cutter, the machine does not use lateral cutter reciprocation. The cutter is reciprocated once tangentially to the gear while the two are rotating in mesh (Fig. 3).

Continued on Page 3

ANNOUNCE Standardized CONE-DRIVE GEAR SETS

Standardized Cone-Drive gear sets in 99 sizes and ratios are now being carried in stock by the Cone-Drive Division of Michigan Tool Company.

The standardized sizes have been developed to facilitate the work of design engineers, etc., in

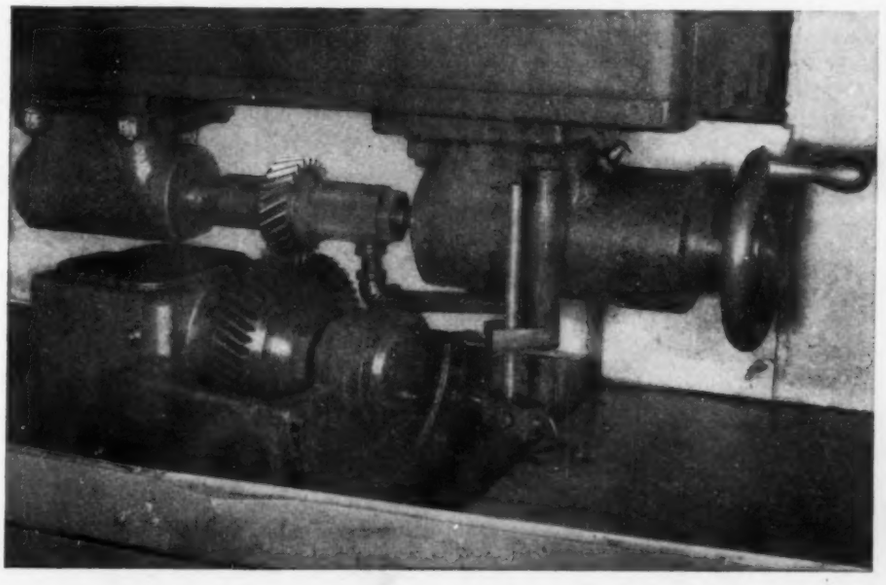


Typical standard Cone-Drive gear and pinion set now carried in stock.

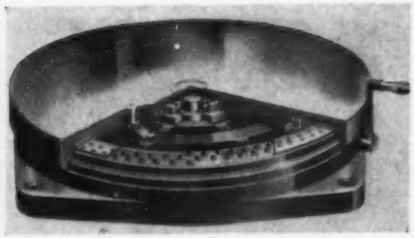
quickly selecting the size and ratio of gear best suited to each specific power transmission requirement. Cost reductions on purchase of gear sets and expediting of deliveries are natural consequences of

Continued on Page 2

Fig. 1—Michigan underpass curve-shaving machine in which curve-shaving action is designed into the cutter. Produces 110 gears per hour with .004" to .006" stock removal.

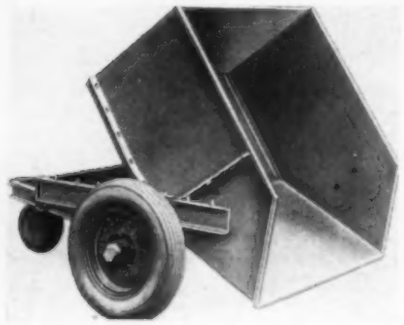


MICHIGAN TOOL COMPANY 7171 East McNichols Road DETROIT 12, -- U.S.A.



INDEX TABLE—An index table which indexes manually and locates automatically is made by the Robbins Engineering Co., 318 Midland Ave., Detroit 3, Mich. The locations of the index positions are determined by the applications, while a safety stop permits unidirectional indexing. The table features a ball bearing designed to eliminate out-of-parallel conditions due to vertical thrust by cutting tools or heavy parts located off-center

Phil-Dump Trailer Truck Has Roll-Over Type Body



Improvements in the design of the Phil-Dump trailer truck are announced by Phillips Mine and Supply Co., Pittsburgh, Pa.

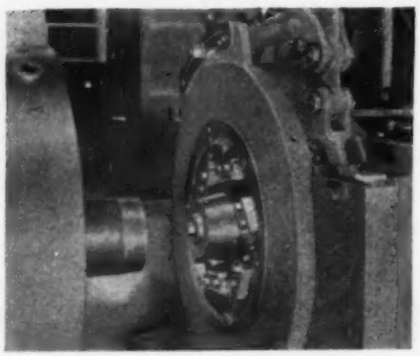
The trailer, which has a roll-over type body, chain release, and quick return, is now equipped with pneumatic tires and an optical center caster for greater maneuverability in hauling scrap or other materials. Capacity is 1 cu. yd.

Wilson Automatic Electrodes For Flat-Position Operation

Five Una knurled-type automatic wires and five Una flux-impregnated tapes have been announced by Wilson Welder and Metals Co., Inc., 60 E. 42nd St., New York 17, N. Y.

Designed for flat-position operation, electrode applications include thin-gage, sheetmetal forms, axle housings, boilers and torque tubes. The wires can be used separately or in conjunction with the tapes, and are available in several diameters and alloy analyses.

New Landis Centering Pilots For Pipe-Threading, Cut-Off Machines



A centering pilot designed for 8⅝-in. and 13⅜-in. receding-chaser pipe-threading and cut-off machines has been developed by Landis Machine Co., Waynesboro, Pa.

The pilot is bolted onto the rear of the crossrail and forms a center in the bore of the diehead. This requires removal of cut-off slides, limiting the machine to threading. Only the rear chuck grips the pipe during the threading operation, while the pilot is forced forward by a spring and engages the bore of the pipe prior to the pipe advancing to the chasers. The pipe is thus centered true with the diehead assuring concentric threads and high threading speed.

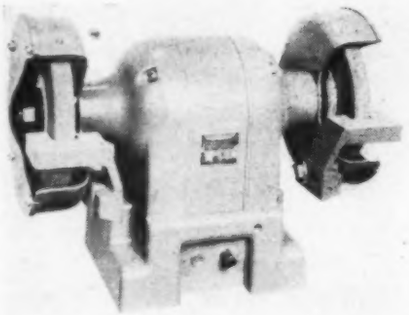
Ames Portable Hardness Tester Test Rounds, Flats up to 1 in.

A portable hardness tester which measures depth of penetration in materials to test the degree of hardness has been developed by Ames Precision Machine Works, Waltham 54, Mass. The tester weighs less than 2 lbs.

A diamond-point penetrator for hard materials and a ball-point penetrator for relatively soft materials are read, respectively, on the "C" and "B" scales.

Screw action is employed in the tester, and pressure is applied in kg. loads to force the penetrators into the materials. The pressures cause the C-frame to spring, moving the dial indicator. The barrel graduations denote hardness in Rockwell B and C scales. Charts for testing in Rockwell A, B and C scales are included.

Black and Decker Bench Grinder Has Rough- and Fine-Grade Wheels



A 6-in. heavy-duty bench grinder with a medium-grade wheel for rough fast work and a fine-grade wheel for finishing and tool sharpening has been developed by Black & Decker Mfg. Co., Towson, Md.

The guards permit a 3-section wire wheel brush without changing the set-up. A machined hole is provided on the grinder base for attachments. The 2-hole push-button switch is recessed in the housing as a safety factor. The grinder can be bolted to a bench or mounted on a pedestal.

Nickel-Silver Welding Rods Suited to Low-Temperature Use

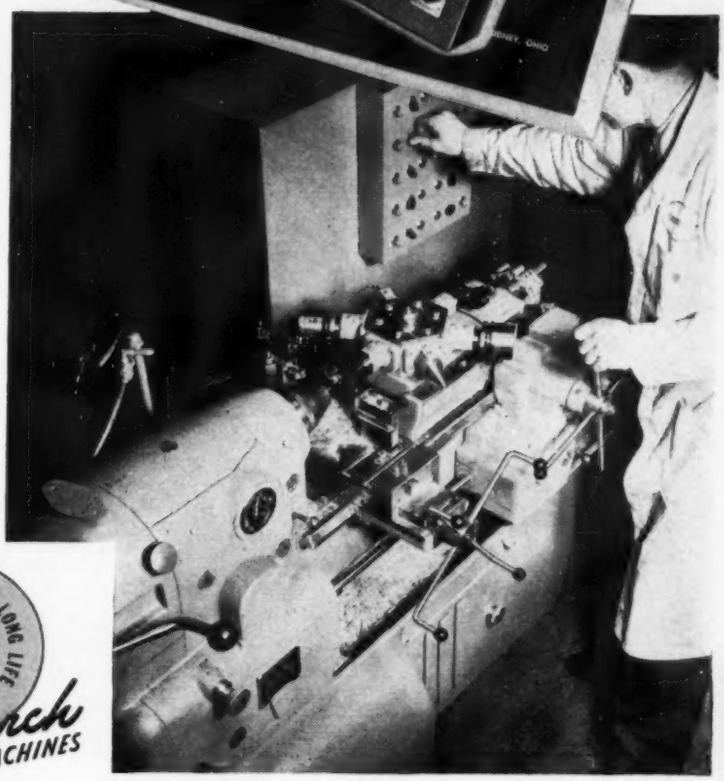
Two nickel-silver welding rods are announced by All-State Welding Alloys Co., Inc., 96 West Post Road, White Plains, N. Y. One of these rods is recommended for production and fabrication of light steel and nickel alloy sections, and is suitable for low-temperature welding of steel, stainless steel, copper-nickel, and nickel. The other rod is for use where resistance to frictional wear is desired and for work on worn or broken parts.

To Save Time and Money on This Class of Work

Get this Book →

"World's Fastest Hand Screw Machine"—that's what you'll call the Monarch Speedi-Matic after you've seen it in operation. On lots of 25 to 500, or more, it will give you peak production at a profit; you'll get *toolroom accuracy at production line speed.*

Typical examples of actual jobs, as well as principal features and specifications of the Speedi-Matic, are described and illustrated in our new 20-page catalog, form 1901. To make certain you receive your copy promptly, use the handy coupon below—or write to The Monarch Machine Tool Co., Sidney, Ohio.



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TURNING MACHINES

The Monarch Machine Tool Co.
Sidney, Ohio

I'm interested in hand screw machine production at a profit. Send me your new 20-page catalog, form 1901, on the Speedi-Matic.

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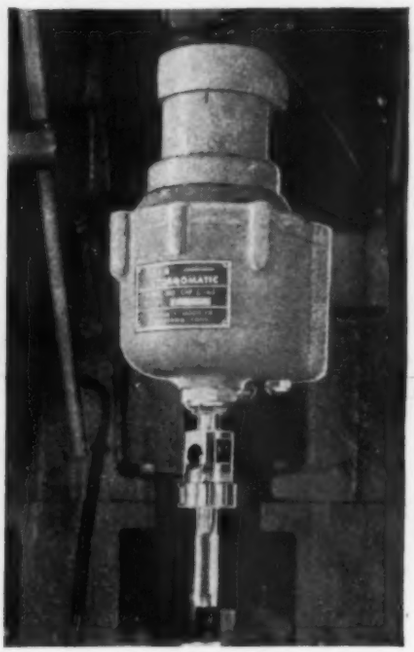
FOR PEAK PRODUCTION AT A PROFIT—

Speedi-Matic Star Features

- ★ Automatic electronic speed change, preselected for as many as ten stations.
- ★ Complete range of spindle speeds—50 to 5000 rpm.
- ★ Feeds from .0005″ to .016″ per revolution.
- ★ Power feed ram-type turret.
- ★ Spring-return hand-operated cut-off slide.
- ★ Air-fed pusher-type collet attachment.
- ★ Collet chuck capacity—7/8″.

Jarvis Tapping Attachments Made to Fit Any Drillpress



A torque-driven tapping attachment is available in three sizes from The Charles L. Jarvis Co., Department 10, Middletown, Conn.

The Torqomatic comes in standard or built-in models, and it can be made to fit any drillpress or tapping machine. It will tap a wide variety of materials with little change in drillpress pressures.

Steward-Jackson Drafting Rule Has Eight Calibration Scales

The Vant Rule, a transparent plastic drafting scale, is made by Stewart-Jackson Instrument Co., 215 W. 7th St. Los Angeles 14, Calif.

Eight different scales are incorporated: 1/8, 1/4, 3/8, 1/2, 3/4, 1, 1 1/2, and 3 in. per ft. Overall length is 13 1/2 in. with the scales reading to 12 in.

Standard Buffer and Polisher Has Infinitely Variable Speed

A 2- and 3-hp. infinitely variable-speed buffing and polishing machine has been redesigned by The Standard Electrical Tool Co., 2480 W. 6th

St., Cincinnati 4, Ohio. The model illustrated is of enclosed spindle construction with four ball bearings. Exposed spindle contruction is available.

Spindle speeds between 1500 and 3000 rpm. are available by "Speedial" control on nine standard line models varying from 1 to 15 hp.

Lewis-Shepard Power Jacklift Has Electric-Button Operation

Vertical-handle operation and an electric brake are featured in platform- and pallet-model jacklifts built by Lewis-Shepard Products Inc., 248 Walnut St., Watertown 72, Mass.

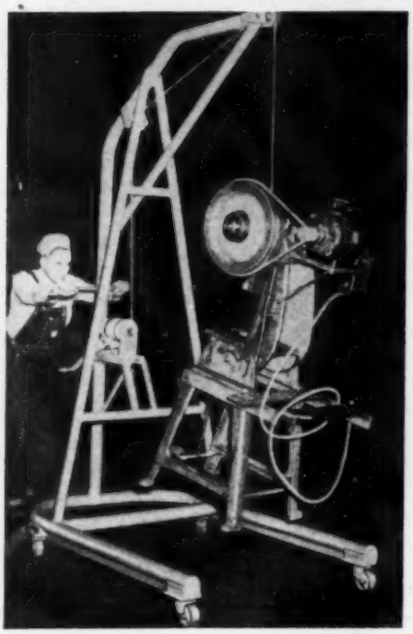
The power jacklift is a hand lift truck electrically controlled by push-buttons located in the handle head, and all operations can be performed with the handle vertical. An automatic electric brake takes over when the handle is released.

Aim Products Vernier Height Gage Measures in Inches or Metrically

A quick-action vernier height gage measuring in hundredths of inches from 0 to 6 in., in fractions by 64th's, or metrically by 10th's of millimeters to 15 cm. has been released by Aim Products Co., 1564 Main St., Springfield, Mass.

The gage operates by turning a plastic knob. Attachments are available for holding standard indicators, depth gages and pencil-lead.

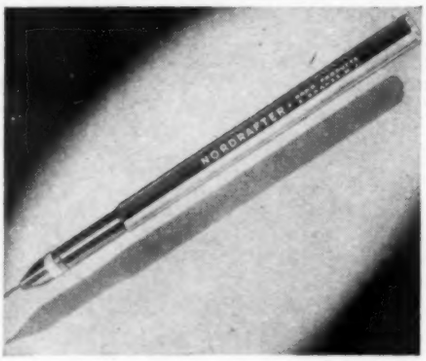
Almco 1-Ton Universal Hoist For Lifting and Transporting



A U-shaped mobile hoist for transporting and lifting is made by Almco Inc., 231 East Clark St., Albert Lea, Minn. Of 1-ton capacity, the hoist can be furnished with a hand-operated worm-drive winch, an electric hoist or a chain hoist.

The 9 ft. high model permits a lift of 8 ft. 5 in. with a 3-ft. clearance between the hook and vertical frame. The base is 6 ft. long x 46 in. wide with a 40-in. clearance between legs, and net weight is 345 lbs. A 7 ft. high model is also available.

Hardened, Knurled-Steel Grip On Nordrafter Drafting Pencil



A drafting pencil consisting of an aluminum body with a 4-jaw collet attached is available from Nord Products, East Orange, N. J.

The pencil measures 6 in. long and has a hardened, knurled-steel grip. No moving parts aid in long life.

True then . . . still true today

"Lubricated-for-Life"

● When, in 1927, New Departure first introduced the "lubricated-for-life" ball bearing, there was naturally a little skepticism on the part of the bearing users. It had never been done before!

But there were so many advantages to the user in the self-sealed ball bearing that it was not long before it "caught on."

Now, twenty years later, more than 110 million N-D-seal ball bearings have been used successfully. They are to be found wherever wheels or shafts turn.

The advantages are briefly:, Simplified assembly, the saving of many small parts, no maintenance expense, lubricant kept in — dirt is kept out.

Write for illustrated booklet "Sealed" and folder IB, showing latest types of self-sealed ball bearings, including those of standard single row width.

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BALL BEARINGS

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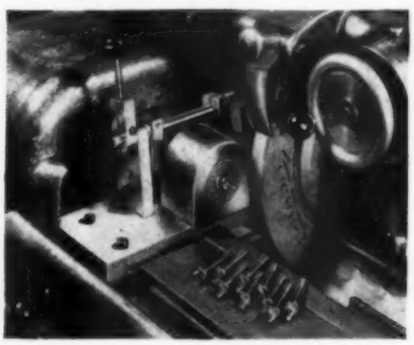
NEW DEPARTURE • Division of GENERAL MOTORS • BRISTOL, CONN. • Branches in DETROIT, CHICAGO, LOS ANGELES and Other Principal Cities

Faxfilm Dual-Projection Unit Compares Machined Finishes

A dual-projection unit, Model D-30, which provides comparison of production and standard finishes is produced by The Faxfilm Co., 1220 W. 6th St., Cleveland 13, Ohio.

The Faxfilm process is claimed to make plastic replicas of surfaces in less than a minute and produce three-dimensional images at 10- to 200-dia. magnification. In the D-30 the images of comparative finishes appear side by side at 30-dia. magnification on a screen at the base of the case. The unit weighs 27 lbs., requires 2 sq. ft. of space. It may be used on 110-120 volt ac. or dc.

Zagar Tool's Collet Fixture Is Opened While Grinder Runs



A collet fixture for use on standard plain grinding machines has been developed by Zagar Tool Co., Inc., 23880 Lakeland Blvd., Cleveland 17, Ohio. The tool, described in Catalog AM-2, is used to grind parts without centers, which can be held in collets. It runs on its own ball bearings and is driven by the headstock of the machine.

The collet can be opened and closed while the grinder is running. It is adaptable to any make or model of grinder. Because the collet does not move lengthwise, overall dimensions can be held. Maximum collet capacity of the fixture is 2 in.

Vascoloy-Ramet Masonry Drills Have Offset, Straight Shanks

A line of Red Streak carbide-tipped masonry drills has been announced by Vascoloy-Ramet Corp., North Chicago, Ill.

The drills are designed for drilling non-metallic material, and are available in offset and straight shank designs in drill diameters of 0.198 to 1.535.

Covel Tool-Grinding Arbors Designed for Milling Cutters

A set of straight tool-grinding arbors has been announced by Covel Mfg. Co., Benton Harbor, Mich. Designed for use on any tool and cutter grinder, the arbors provide a means of grinding cutters without changing footstock or tailstock positions.

The arbors have a capacity for tools with face width to 6 in. and 10-in. length. The standard set includes 1-, 1¼-, and 1½-in. dia. arbors, each 10 in. overall length.

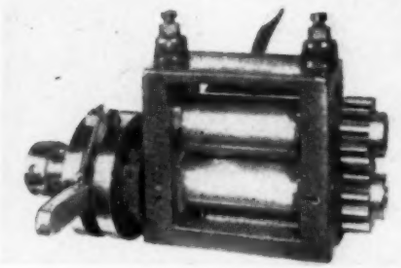
Light Aluminum Construction Used on Thermoid Hand Truck

A general-service heavy-duty hand truck is being manufactured by Thermoid Co., Trenton, N. J. Of light aluminum construction, the truck has a 7-in. steel nose and solid "cut-resistant" rubber-tired ball-bearing wheels.

The truck is 53 in. high x 18 in. wide with 9-in. wheels. The ball bearings have a built-in grease seal for protection against leakage, dust or dirt.

Thermoid Co. also announces a line of 6-, 8-, 9-, 10- and 12-in. aluminum wheels for general industrial application.

One-Step Reversing Operation In Gilbert Friction Roll Feed



A friction roll feed for operations where it is necessary to feed stock into stamping or cutting machines is made by Machine Service Co., 150 Croom St., Providence, R. I.

It is claimed that the feed can be reversed in less than one minute without removing any parts and that the feed can be held as close as 1/3000 in. An automatic pressure release permits easy insertion of stock.

Your automatic screw machines will operate longer between tool changes when you use J&L Cold Finished steel. The uniform Controlled Quality of J&L Cold Finished rounds, hexagons and squares makes it possible for you to set the speed of your machines to obtain maximum efficiency. In addition the close dimensions and inherent machinability of J&L Cold Finished bars will make it possible to produce, at low cost, accurate, highly finished parts.

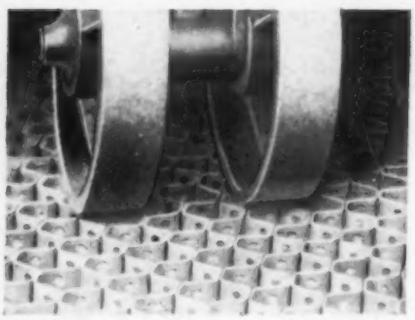
JONES & LAUGHLIN STEEL CORPORATION

PITTSBURGH 30, PENNSYLVANIA

J&L STEEL

Parts and Materials

Klemp Steel Flooring Incorporates Features of Landing-Field Grids



Two steel surface armors for permanent protective flooring are available from the Klemp Co., 6601 S. Melvina Ave., Chicago 38, Ill.

Similar to the flexible grid used by the U. S. Navy in the formation of over-night landing fields, Klemp Floorsteel is a flexible floor armor of cold-rolled strip steel and comes in standard rolls 47½ in. or 60 in. wide x 25 ft. long.

The other surface armor, Klemp heavy-duty Hexteel floor armor is a hexagonal-shaped steel grid. Both can be imbedded in concrete or mastic with their tops flush to take shocks and the brunt of loads.

Superior Steel's Clad Strip Has Nickel or Monel Cladding

A rolled nickel- or Monel-clad strip that combines corrosion resistance and the strength of nickel with the properties of steel has been developed by Superior Steel Corp., Carnegie, Pa.

The strip is available in widths from ¼ to 10¼ in. with coils up to several hundred feet. Cold rolled strips are available in 0.01 to 0.125 in.; hot-rolled in 0.095 to ¼ in.

Cladding is furnished on one or both sides. Standard clad thickness is 10% of total; on single strip the nickel or Monel is 10%, the steel 90%; on double-strip the three layers are 10% nickel or Monel, 80% steel, 10% nickel or Monel.

It is claimed that it is impossible to separate the cladding from the steel by mechanical means or heating, and the strip can be fabricated in the same manner as low-carbon, deep-drawing steel. Similar thermal coefficients of nickel, Monel and steel make for little danger of warping or twisting due to temperature change.

Grain Cement and Thinner Used on Polishing Wheels

A grain cement and thinner has been developed as an adhesive for polishing wheels by the Hanson-Van Winkle-Munning Co., Matawan, N. J. The materials are mixed and then worked onto dry wheels, and they are claimed to overcome the deficiencies of organic glues.

E. F. Houghton Simplifies Line Of Rust-Preventive Formulations

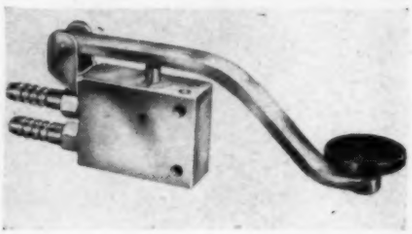
A reduction from 100 rust-preventive formulations, developed during the war, to a line of nine products has been announced by E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia, Pa. Part of the Cosmoline series, four are removable thin-film solvent types, one is a non-removable dielectric variety, and four are oil-type films varying from thin-oil film to medium-grease consistency.

Lord Mounting Is Designed for Universal Vibration Protection

The Multiplane mounting, which is claimed to secure equal softness in all planes and to isolate vibration from all directions, has been announced by Lord Mfg. Co., Erie, Pa.

"Multiplane" mountings are recommended for equipment exposed to vibration of indeterminate nature, such as instrument panels, electronic equipment, air conditioners and blowers.

Three-Way Mead Fingertip Valve Takes Cylinder Bores up to 4 in.



A precision-built three-way fingertip valve has been released by Mead Specialties Co., 4120 N. Knox Ave., Chicago 41, Ill. The valve has the capacity to handle cylinders up to 4-in. bore or more. Button travel is approximately ⅛ in.

Two valves in series can be used to prevent accidents in air press operations. Spaced far enough apart, they require the use of both hands to operate the press. With a simple cam they can be used to synchronize valve operation with a drillpress or other machine tools.

Gulf's Soluble Cutting Oil Has All-Water Miscibility

A soluble cutting oil has been announced by Gulf Oil Corp., Pittsburgh, Pa. The product is claimed to be all-water miscible, have high-lubricating qualities, have a pleasant odor, and non-foaming and rust preventive characteristics.

Marshall Ground Carbon Tool Steel Eliminates Cutting and Grinding

A "prefabricated" carbon tool steel for tool and die makers, machinists and other users is announced by Marshall Steel, 228 N. Lasalle St., Chicago 1, Ill.

Designed to eliminate cutting to size, shaping or planing, and grinding operations for steel buyers, the steel is available in 18-in. lengths and varies from 1/64 to 1¼ in. thick and ¼ to 10 in. wide. It is suited for, among others, templets, models, dies, jigs, gages and fixtures.

DIE COSTS TAKE A NOSE DIVE

Typical examples of set-ups made from stock units. No delay in starting production.

All there is to Whistler punch and die units.

WHISTLER Adjustable Perforating Dies Offer Added Production Economy

WRITE FOR YOUR WHISTLER CATALOGS. Know the production advantages of Whistler Adjustable Dies.

5-10-50 and even more different set-ups with the same dies? Impossible? Not when you use Whistler Multi-Use Adjustable Dies. For it's simple to rearrange these units... add or delete... get back into production within a few hours. Even so-called complicated arrangements are easy to set up. And, with first cost invariably less than for single purpose dies, this continued re-use of the same dies effects added economy in quickly writing off initial die investment. Over 750 prominent manufacturers have proven in their own plants that Whistler Adjustable Dies have sent costs into a nose dive.

No special tools are needed. Work in practically any size and type of press. Ordering now is particularly advantageous. Large stocks of standard diameter units from 1/32" up are available for overnight shipments. Notching, group dies and special shapes and sizes can be quickly made to order. Write today to:

S. B. WHISTLER & SONS, INC.
752-756 MILITARY ROAD BUFFALO 17, NEW YORK

Double-ended, pipe bending press—125-62½ tons capacity. Designed to handle pipes and tubes from 2½" to 14". Request catalog page W-334.

BIG BENDS . . . little bends . . . complicated bends . . . are all handled with ease and accuracy on R. D. Wood hydraulic bending and straightening presses. Self contained, these presses are under positive control of the operator at all times . . . an important feature during difficult bends. Their heavy-duty construction means longer life with a minimum of maintenance. Wood builds these presses in a full range of types and sizes for pipes, tubes and structural shapes . . . as well as many other types of hydraulic presses. Outline your needs so that we may send descriptive literature, or the advice of our engineers where the requirements are unusual. R. D. Wood Company, Public Ledger Bldg., Independence Square, Philadelphia 5, Penna.

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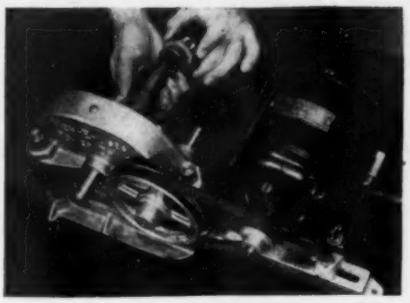
R. D. Wood Company

Flinchbaugh Co. Power Drive Has Range of 20 to 750 rpm.



A variable-speed power drive for fractional motors which has a range from 20 to 750 rpm. when used with 1725 rpm. motors, is produced by the Flinchbaugh Co., 750 S. Court St., York, Pa.

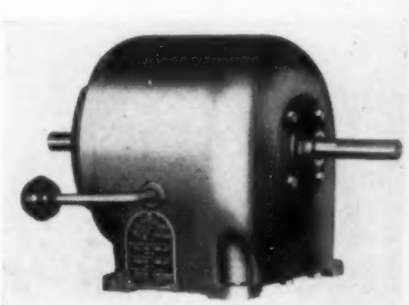
With the addition of an auxiliary shaft, speeds down to 4 rpm. are possible. Either direction of shaft rotation can be obtained by mounting the motor to right or left on the base. The device is called the "Men-E-Uses" power drive.

Henry SV-11 Solenoid Valve Is for Small Capacity Use

The SV-11 solenoid valve for small capacity installations involving freon, methyl chloride, oil, gas, and air, among others, has been announced by the Henry Valve Co., 3260 W. Grand Ave., Chicago 51, Ill.

The SV-11 is incorporated in a standard outlet box and is furnished with ⅜-in. FPT connections in 115 volt, 60 cycle and 230 volt, 60 cycle. The coil can be replaced without disturbing connections to thermostats or other devices.

Lima Four-speed Transmission Is for Fractional Hp. Motors



A selective-speed gearshift drive, Type RD, is announced by the Lima Electric Motor Co., 1501 Findlay Rd.,

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COUPLINGS

AIR, OIL—GREASE COUPLING

OXYGEN COUPLING

ACETYLENE COUPLING

Hardly a day passes that adaptations to new uses for Hansen couplings are not found—many being discovered right in the field.

The possibilities of Hansen Couplings are unlimited because of their simplified design, adaptability, and remarkable performance. They can be used anywhere, within their wide range of standard sizes, on anything that handles air, oil, grease, oxygen or acetylene—and will handle pressures from ounces to 10,000 pounds.

To connect a Hansen hose coupling, you merely push plug into socket—to disconnect, slide the sleeve back with your thumb. In both cases, flow is immediately and automatically turned on or off. No time wasted, no losses.

FOR
OXYGEN
ACETYLENE
AIR, GASOLINE
OIL, GREASE
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The adaptability of Hansen Couplings to so many different uses is the best possible evidence of their correct design. Our representatives will be glad to discuss with your engineers the possibilities and advantages of Hansen Couplings.

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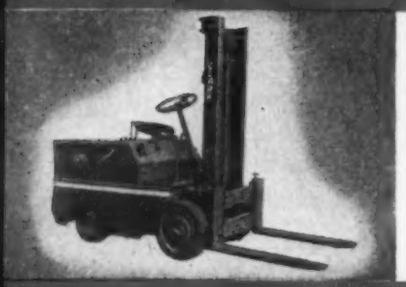

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ABOVE EVERYTHING ELSE . . . in the material handling field, Clark Methods and Clark Machines are outstanding, permitting maximum savings in man hours and handling costs. The full story in pictures—"Material Handling News"—is yours for the asking.

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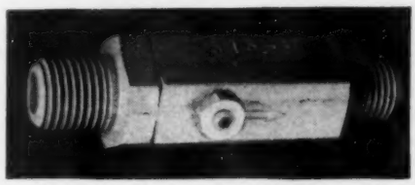
Prices on CLARK products will not be advanced in excess of increased costs.

Lima, Ohio. It can be used with any standard motor of ¼ to 1 hp.

The transmission has gear ratios of 1 to 1, 1.33 to 1, 2 to 1, and 4 to 1. The design is similar to that used on direct motor-driven Lima gear-shift drives. The shift lever is available in four optional positions.

Electrol Speed-Control Valve Uses New Metering Procedure

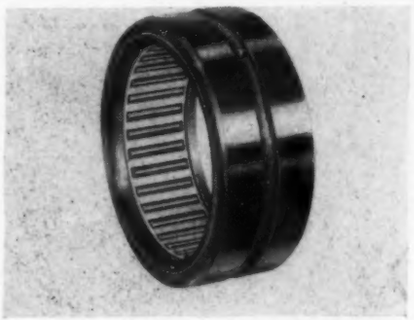


A speed-control valve incorporating a new metering device has been released by Electrol, Inc., Kingston, N. Y.

The valve allows free flow in one direction, and, by means of screw-actuated metering pin, controls the flow in the opposite direction. The small control area involved is said to provide "pinpoint" control of the rate of flow.

Electrol speed control valves have ⅛-, ¼-, ⅜-, and ½-in. NPT port sizes and can be used with pressures up to 1500 psi.

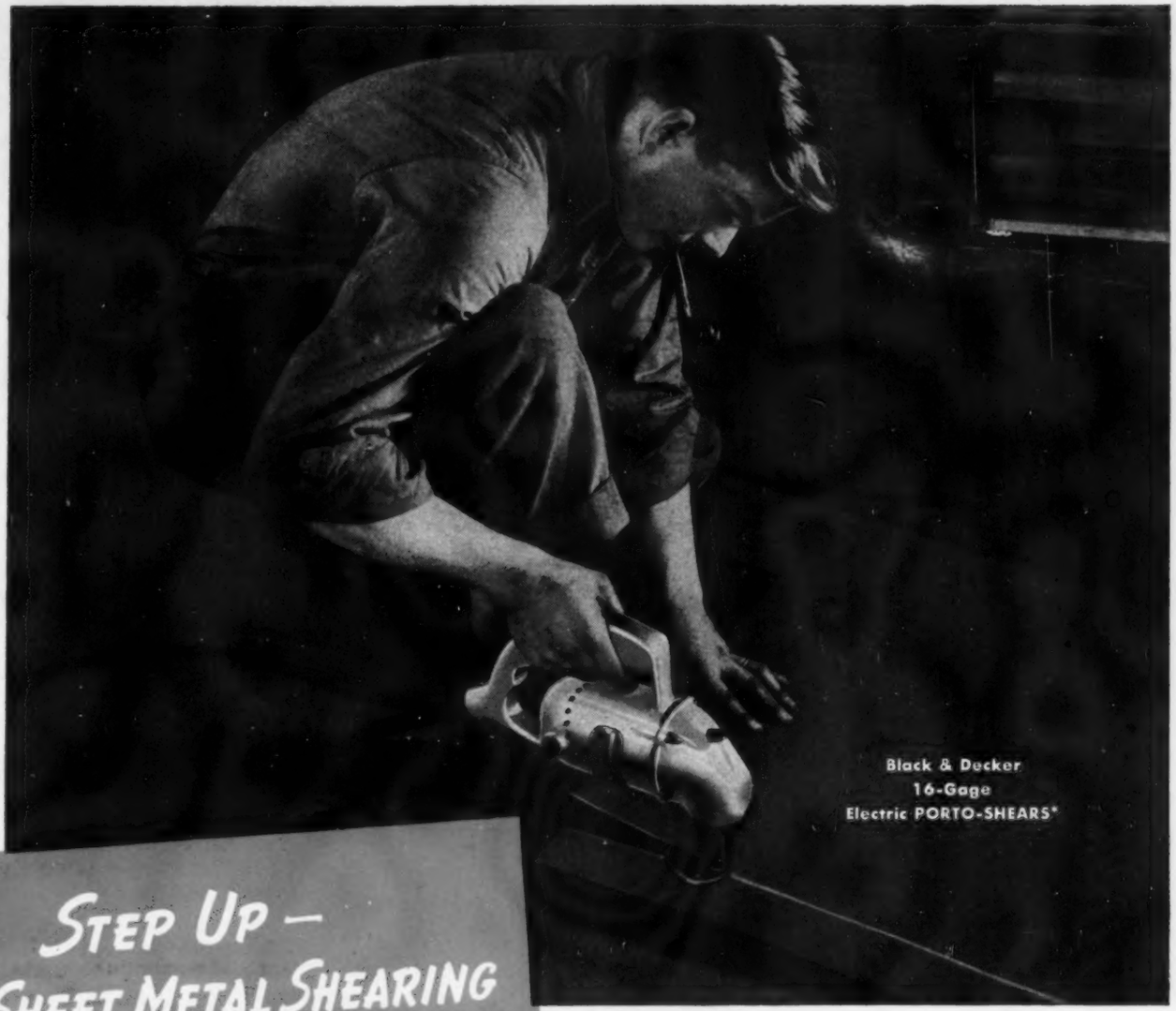
Orange's Needle Bearings Are Built in Cage Type



A cage-type needle bearing designed to provide permanent alignment of rollers has been developed by Orange Roller Bearing Co., Inc., 557 Main St., Orange, N. J.

The rollers run in a cage in pockets coined to the roller contours and have square ends to provide maximum length. All retaining rings, race-ways and rollers are "Pentrate" finished to reduce friction and corrosion.

Especially adapted for high-speed and spindle applications, vertical and overhung, the bearing is available in a long range of shaft sizes.



STEP UP — SHEET METAL SHEARING SAVE MONEY, MUSCLE, MANPOWER

*Trade Mark Reg. U. S. Pat. Off.

BLACK & DECKER Electric PORTO-SHEARS combine powerful shearing action with surprisingly rapid speed. They cut sheet metal too tough for snips. Speed up jobs where snips are slow. Feed easily with only a light forward pressure.

CUTTING OPERATION ALWAYS VISIBLE

You can watch PORTO-SHEARS cut through the work. That's why it's easier to follow straight lines, irregular patterns, curves down to 3/4" radius, without fear of rejects. There are no burrs or ragged edges, either, because PORTO-SHEARS make cleaner, smoother, more accurate cuts.

CUT MANY MATERIALS

Black & Decker 16-Gage PORTO-SHEARS cut up to rated capacity in steel or galvanized iron—about one gage thinner in Monel or stainless—50% above rating in copper, aluminum, lead and other non-ferrous metals. Can be adapted to cut thin sections of laminated wood or sheet plastics.

SEE YOUR BLACK & DECKER DISTRIBUTOR. He'll be glad to give you full information on time-saving PORTO-SHEARS—or help you with any other tooling problem. For your free copy of our complete catalog, write to: The Black & Decker Mfg. Co., 616 Pennsylvania Ave., Towson 4, Md.

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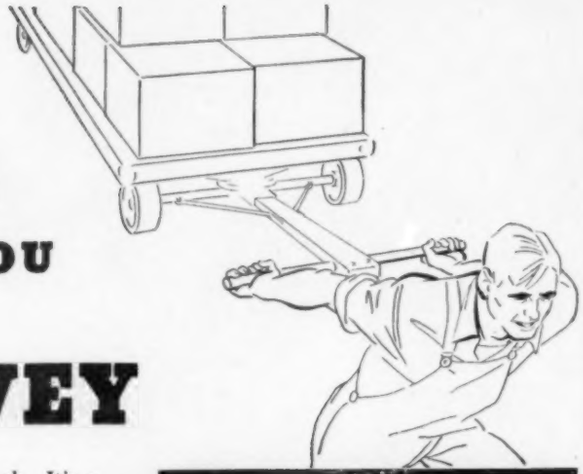

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PULLING costs too much. It's a waste of time and manpower. Conveyors can stop this waste. Investigate the use of conveyors. Conveyors handle a wide variety of parts, packages, units, cans, bottles, barrels, bundles, drums and boxes. Available in light, medium or heavy-duty types — portable or stationary — as systems, sections or units — power or gravity fed, they give you remarkable savings in time, money and manpower conservation. They relieve confusion and congestion. Standard Conveyor Company has the experience and facilities to engineer, recommend and furnish the right type of conveyor for your particular needs.

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Conveyors keep production moving without interruption.

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Handibelt portable conveyor helps pile cartons higher and faster in a warehouse.

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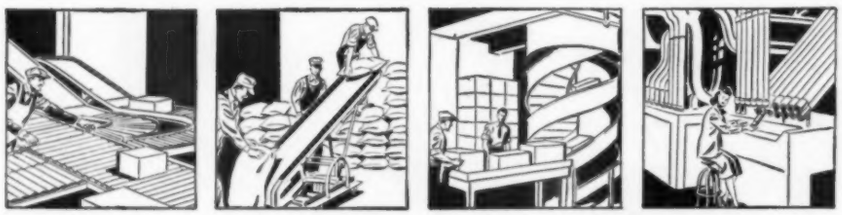
Cases move fast into cars on sectional roller conveyors — with less manual handling.



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ROUND TABLE *Discussion*

DO MACHINES MAKE JOBS— OR TAKE THEM?

In this controversy, our vote went straight to Al. Ed's views on the subject are so un-American that his cousins here across the pond feel his liver bile needs stirring up. We felt something had to be done about Ed, so we held a staff inquest. Said the machine-shop "super": "For the love of Mike, don't let the old man read that bilge or it's goodbye to the three new Monarchs he half promised us." "Ed must be crazy," argued the production boss, "How could *we* ever get through that steelwork contract without the new Pratt & Whitney slotter which let us lay off two veteran machines and freed the other machinist for the new Hydromotor shaper? Old Ned had to be pushed on to the new Pratt; now he can't bear to leave it. Calls it his silent knight."

The personnel officer held that Ed's opinions were of international concern, and in view of manpower shortage the present time was just right for breaking up all "has been" plant and flooding the workshops of the world with modern time-savers to free more machinist for the shops so much in need of skilled help.

Everyone agreed that well-planned high production meant low costs, higher wages, increased demand and more and better jobs. Well-paid employment means greater spending power and that *creates* new markets. The old millwright foreman wondered if Ed had never heard of Henry Wallace, but everyone knew he had got it wrong and meant Henry Ford. The labor boss said, "Ed must have caught a 'ca canny' microbe, probably in a food parcel from Britain!" 'Ca canny' means, over here, work-shy and is quite definitely restrictionist in practice and therefore anti-social—"the disease of ease," the labor boss calls it.

The sales boss contended that only by higher and higher and cheaper and cheaper production could we hope to pull through the critical period ahead. He pointed out that a fully employed, well-paid population was the dream of all wise manufacturers who could not sell their products if half the people were without work and hard up.

He showed us how the spending

the Machining factor in "OK" steel forgings

● A steel forging—no matter how "clean" its steel, how expert the forgesmithing, or how careful the heat treating—is not a working piece of equipment until it is rough and finish machined. On such exacting parts as Diesel crankshafts, machinery spindles, periscope tubes and other heavy duty forgings, National Forge machining has long held high rank for the precision craftsmanship of its operators.

The National Forge machine shops are well equipped with modern machine tools, both large and small, in which a great range of work can be performed. In addition to the production of finished machined forgings, the equipment is also available for contract machine work. For this latter field of production a well set up assembly department has been established for the completion of assembled units. Why not know how much more National Forge can do for you now?

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AND ORDNANCE COMPANY
Irvine, Warren County, Pennsylvania

sheave cutters

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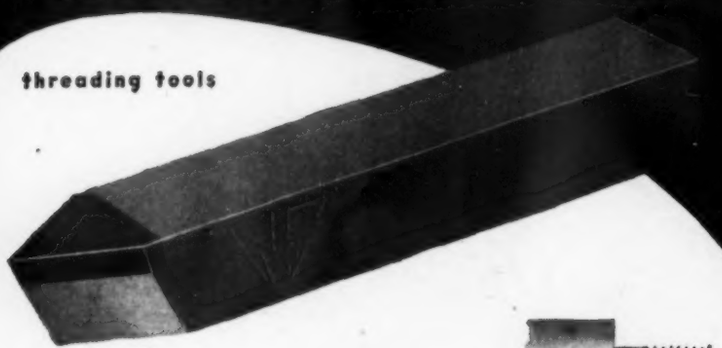
PRODUCTION GROOVING AND THREAD CUTTING

WENDT-SONIS CARBIDE TOOLS

threading tools



Now! Grooving and thread cutting operations can be done faster, more economically with Wendt-Sonis Carbide Tools. Each tool is especially designed for its job. Available from stock in a wide range of sizes and grades. Shanks scientifically hardened. Cutting angles are based on exhaustive tests made under actual production conditions. Use Wendt-Sonis Carbide Tools to increase your production — help combat rising costs. Get complete details by writing WENDT-SONIS COMPANY, Hannibal, Missouri or 580 North Prairie Avenue, Hawthorne, California.

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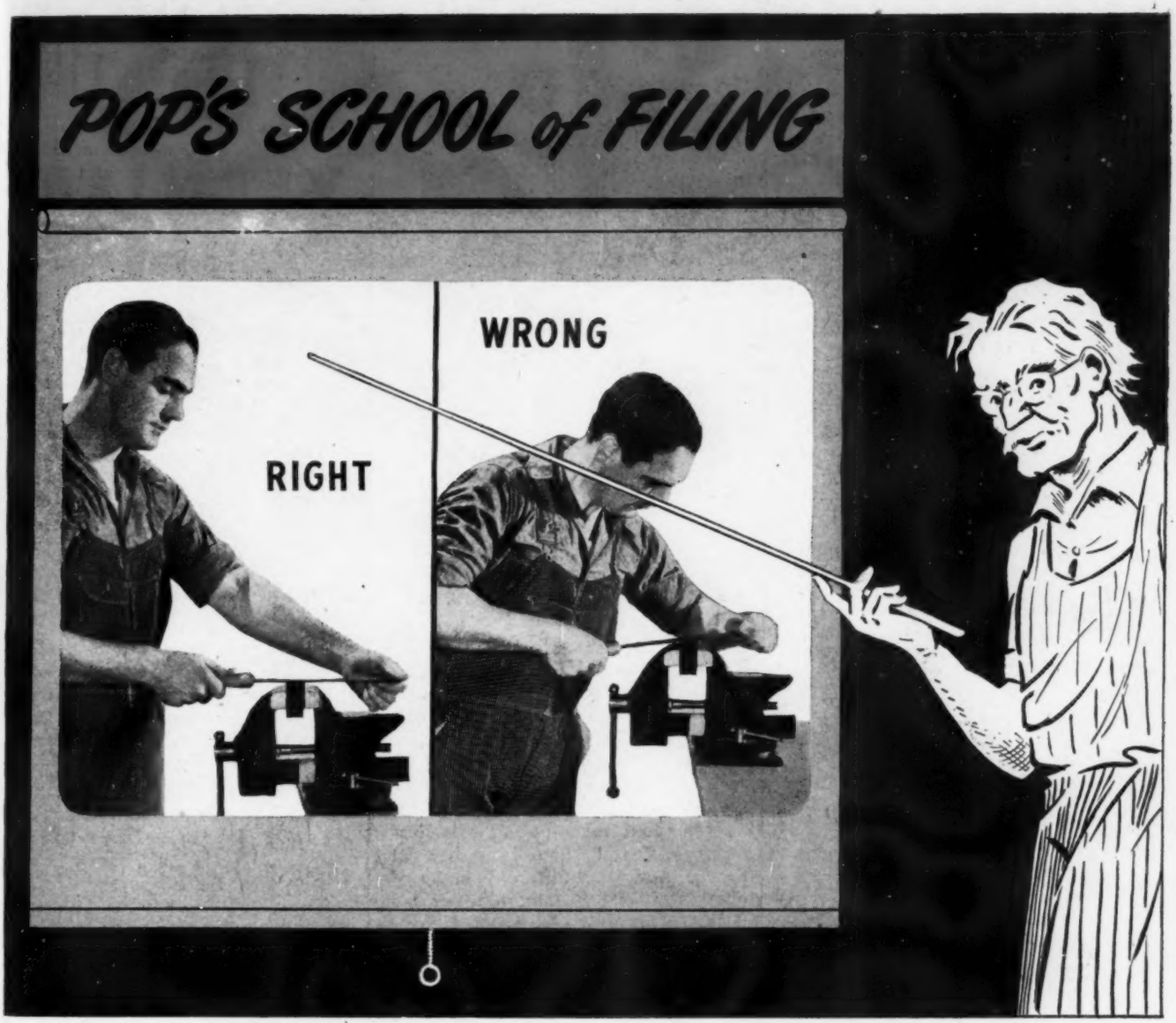
CARBIDE TIPPED CUTTING TOOLS

BORING TOOLS • CENTERS • COUNTERBORES • SPOTFACERS • CUT-OFF TOOLS • DRILLS • END MILLS • FLY CUTTERS • TOOL BITS • MILLING CUTTERS • REAMERS • ROLLER TURNING TOOLS • SPECIAL BITS

power from full, well-paid employment made us, the employees, the instruments of progress, how if each of us could afford, say, two suits instead of one per year that would create a demand for more cloth, more thread, more buttons, more textile and button-making machines, more foundries, patterns and shipping. More shipping would mean more shipbuilding, more trains, engines, wagons and coaches and men to run them. In addition there would be demands for vacuum cleaners, refrigerators, radios, sewing machines, etc., etc. because we would have money to buy such things oftener as new and better models came off the line. While those demands were being met, he said financing of backward foreign lands could be planned, in return for their raw materials, and as those people became fully employed at good wages they would want to buy our consumer goods and *their* standard of living would rise and a market would thus be created, providing years and years of full employment and good wages for us in return for our help in the development of their country.

The secretary thought that "U.N." could get all the countries of the world to appreciate the value of spending power to world trade, in only a few years slow-downs, limited production rates and minimum numbers of workers employed would become history. His strong suit was that if the masses of the world had adequate spending power the demand for consumer and capital goods would be such that all would be fully employed for many years to come and the way to achieve that was to go all out now for modern high-speed machines and cheap production. The volume of work in front of the manufacturing countries today and the potential demand would start the ball rolling, and as "U.N." extended the scheme to the most backward countries, the trade possibilities would become almost unimaginable. He went further and said if those possibilities could be exhausted, which he doubted, we could then turn our attention to reduction of hours of work and earlier retirement, but not 'til then. He knows his stuff, does the secretary, and argues that it is only a matter of intelligent *world* planning. He pointed out that when hours of work were reduced, the people would have more leisure and that, in the interests of society generally, many would require to be taught how to make good use of it. This would mean a great amount of adult education, possibly calling for more schools or

POP'S SCHOOL of FILING



YES, Pop the Foreman is back. He's that mythical shop character who appeared in many a Nicholson wartime advertisement. Hard-bitten and sometimes hard-speaking, but always helpful, Pop is devoted to the cause of good filing—dishing out sage advice that has made many a mechanic more valuable to his employer and to himself.

Pop's peacetime "School of Filing" is now open to mechanical trainees, industrial employees, shop bosses, production and purchasing heads—to anyone, in fact. At right is his first "quiz" lesson. Pass it around, and let the answers fall where they may. Most of them will be found in the well-known Nicholson "text book," *FILE FILOSOPHY*. Pass that book around, too. Free copies for reference distribution around the plant are available in limited quantities. Tell us how many you need.

NICHOLSON FILE CO. • 29 ACORN ST., PROVIDENCE 1, R. I.
(In Canada, Port Hope, Ont.)

POP'S QUIZ FOR TODAY

(Correct answers may be found on FILE FILOSOPHY pages indicated in parentheses)

1. What things is the mechanic in the "Wrong" picture doing incorrectly? (p. 30)
2. What three important things must the filer do right to do a good filing job? (p. 28)
3. What are the three elemental ways in which a file can be put to work manually? (pp. 28 and 29)
4. What is the proper height for work in vise for (a) general filing; (b) heavy filing; (c) delicate filing? (p. 29)
5. What accessories should be used for holding soft metals in vise for filing? For round pieces? (p. 29)
6. What is the most generally accepted way of holding a file for ordinary filing? (p. 29)
7. What is the proper grip for one-handed filing? (p. 29)
8. What is the proper way of "carrying" the file across the work? (pp. 29 and 30)
9. What is drawfiling and how should file be held and "carried"? (pp. 30 and 31)
10. How should file be held against work in lathe filing? (p. 31)
11. What general-purpose file is normally capable of doing good lathe-filing work? (p. 31)
12. What special file is made for lathe filing and what are its features or characteristics? (p. 31)

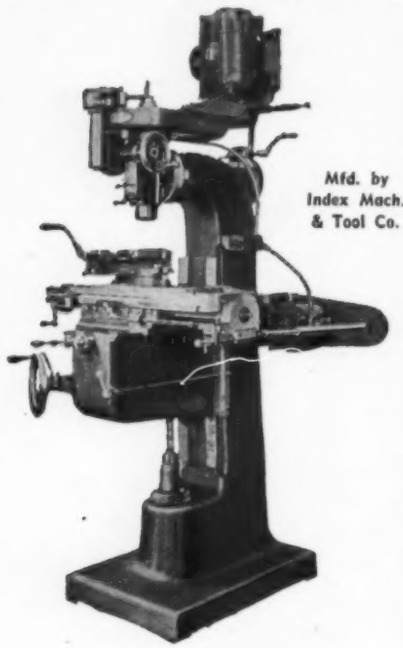
NICHOLSON U.S.A.

NICHOLSON FILES
for every purpose

BLACK DIAMOND TRADE MARK

INDEX MILLS

will help you on your tool, die and production work. In addition to micrometer dials on screws, verniers are standard equipment for cross and longitudinal locating. If finer precision is desired, rods and indicators are available. These in conjunction with power feed to a precision ball bearing spindle make a very versatile machine for milling, drilling and boring. *Literature promptly mailed on request.*



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12" Tool Room Rotary Table

A quality tool for precision work in the tool room or production line, incorporating such features as ball bearings—hardened and ground worm—quick acting throw-out for free hand turning—single movement table lock that does not cramp table out of alignment—compound trough. 12" size only.

For use on Index Mills or any other machine that will accommodate a 12" table.

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JACKSON, MICH.

colleges, teachers, lecturers, libraries, recreation fields, etc., all of which would bring about what might be called recreational employment. The cashier proposed that a full report of the inquest be sent to Ed to cheer him up. As this was carried unanimously, herewith, please find the report.

E. D. Mackinnon
Lanarkshire, Scotland

•

ROLLING STONE

The subject of drifters, or "rolling stones," interested me very much and I should like to present here what I think is a greater-than-usual fund of experience which might be of help to others (I hope).

I have found that the roving type of worker does indeed gather a certain polish on his mechanical ability. But it is a costly process both to him and to his employer. Somebody must pay to knock off those rough corners.

Older, accomplished, experienced men have favored, to a reasonable extent, a man's shifting from one job to another. Most of them felt that the young man completing an apprenticeship in trade school or factory should not immediately get a permanent machinist's or tradesman's job, but should try several to see how the different factories operate, to learn something of his industry, gather experience, and then decide in which branch of the industry he wants to specialize (which is a growing trend). Having this opportunity to sample the field first, the man is in a better position to select the job which is best suited to his individual liking and needs and one in which he can be content to stay "put."

On the other hand, this moving about from job to job has its dangerous points too, for there are some men who might just let it develop into a habit. As a rule, in hiring men, employers think in terms of taking on a worker who will become a permanent employee. Training a new man is a costly process to the firm and they don't want to go to all the trouble of breaking him in, only to have him leave for another job. For this reason, employers are a little wary of a man whose past record shows that he has been a job-hopper, unless he has good reasons for the changes. A habitual shifter may eventually find it difficult to get a job.

From my experience, if a man has his mind set on settling in a certain

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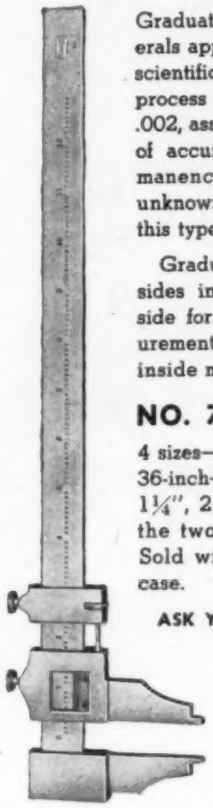

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Graduated on both sides in English—one side for outside measurements, the other for inside measurements.

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4 sizes—6, 12, 24 and 36-inch—length of jaws 1¼", 2⅜" and 3" on the two larger sizes. Sold with or without case.

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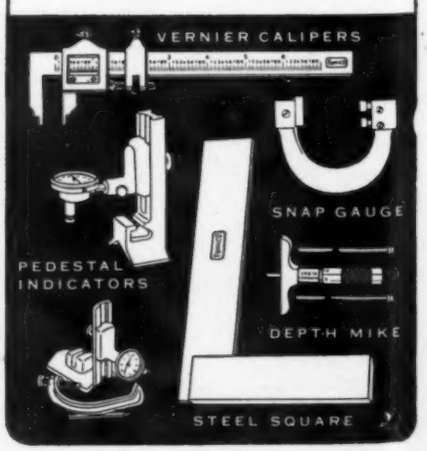

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● YOU'RE LOOKING at a totally different ball bearing . . . the Fafnir High-Load Ball Bearing. Unlike standard ball bearings, this new anti-friction bearing is not designed to handle the terrific speeds of spinning shafts. Instead, its purpose is to smooth out the action of oscillating and rolling assemblies. It's made to take more pounds of weight, size for size, than the usual ball bearing. Not only weight but abuse, dirt and moisture.

It's lighter than other bearings but you don't see the real difference till you take off the patented Plya-Seals. The space between inner and outer races is packed with hardened steel balls. No separators. That's the full ball complement for greater weight sustaining and smooth action. All exposed surfaces are cadmium plated or of corrosion resisting material. The PLYA-SEAL keeps in lubricant, locks out dirt and moisture. Made to inch instead of metric dimensions. Bores fit standard bolt sizes.

The Fafnir High-Load offers alert manufacturers ball bearing smoothness where ball bearings were never used before . . . because it can be smaller, requires no maintenance and is so easily installed and removed. Now adding new smoothness and accuracy to such equipment as business machines, photographic apparatus, printing presses, paper making machinery, dental and medical equipment and farm machinery. Possibly there's an oscillating or rolling assembly in your new design that you could make a winning feature by giving it Fafnir Ball Bearing smoothness. Send blue prints or write for full information. The Fafnir Bearing Company, New Britain, Conn.

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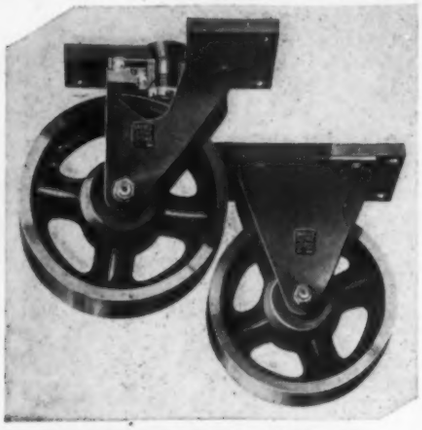

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section of the country, the best thing to do is to work first in five or six plants, doing the type of machine work he thinks he likes, finally stopping with, or going back to, the best place, with the fixed intention of settling there. He'll find that in areas where pay rates are higher, it's because living costs are also higher and that in the end, the two usually balance. Thus, the sooner he settles down with the company of his choice, the better are his chances of going ahead in it.

This moving around is a novelty, but after a while it wears off, and the chore of having to tell the boss that you're leaving becomes bothersome. If your record shows you are a shifter, he'll probably expect it sooner or later and his indifference to your leaving will be noticeable.

Some of these men who move around that I know of do not do it because they are looking for the right company, but rather because they are seeking a sinecure. It's up to the foreman to spot such individuals. This usually isn't difficult, for they are the type who don't exert themselves. Given enough rope, they hang themselves, too. What good will it do to handle this type with "kid gloves"? But the capable foreman will treat each of his men equally and fairly, seeing that they have favorable conditions under which to work. Isn't this a proper labor policy? No new employee rates preferential treatment. What is sauce for the goose is gravy for the gander.

Edward W. Dickavich
Torrington, Conn.

•

IS APPRENTICESHIP SLIPPING?

For the protection of the young journeyman and the employer, the system of apprenticeship of yesteryear is to be preferred.

By this I do not mean the system of 40 years ago where the boy lived in the same house as his employer and was more or less (mostly less) one of the family, but rather the type of apprenticeship where the young man has his own place to live in and is only connected with the shop during working and technical school hours.

In trade schools, a young man is in contact with a large number of young men and is bound to be more careless and assumes an "I don't care" attitude. There is also, in many cases, a shortage of good teachers, and the young man's thought of still being in school does not give him the feeling of responsibility and interest which is required to learn to do a good job.

The chance for the apprentice to learn to be a good journeyman is

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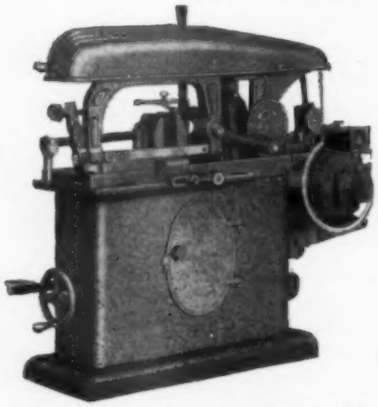
POWER HACK SAWS

CUT CUTTING COSTS



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$365 including motor F.O.B. factory

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Capacity, 6¾x6¾ inches.
Vise swivels to 45 degrees.
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With automatic safety stop switch.
With feed control.
With foot lift to saw frame.
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Length of blade, 12 to 14 inches.
Two speeds available, by shifting belts.
100 to 168 strokes per minute.
½ H.P., AC, 1,725 R.P.M. motor.
Height from floor to top of vise, 22½ inches.
Weight complete with motor, 580 pounds.
Weight complete crated, 634 pounds.
Floor space, 13x27 inches. Length, 40 inches.

KELLER POWER HACK SAWS are built in several models. All engineered to handle the maximum quantity of stock, within their capacity, at any desired angle of cut, with the greatest possible convenience to the operator.

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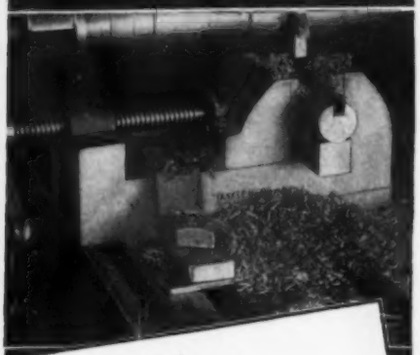
"YANKEE" VISES



Give *Start-to-finish* work holding

Off the swivel base, end down for accurate marking.

Back on the swivel base, at the bench, for center punching.

Litted onto drill press, still accurately in position.

Held in same position but moved to milling machine.

Take a job through every step without a misstep . . . faster, easier . . . in a "Yankee" Vise. Work lined up accurately from bench to drill press, to milling machine and back to bench. Lifts off and on a swivel base at the bench. Vise squared on top, bottom, sides and front end for machine work. Easily made into handy, economical jig. Hardened steel block, V-grooved, provided with each "Yankee" Vise. Four sizes, with and without swivel base . . . 1½", 2", 2¾" and 4" jaw widths. Your industrial distributor carries the full line. **"Yankee" Tool Book FREE!**

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THE TOOL BOX OF THE WORLD

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much better, however, when he is placed in a small shop where several journeymen are employed and all types of work are being performed. A job is started and finished in a small space, and the experiences of several journeymen will be of great advantage to the apprentice.

By the small-shop method, the apprentice learns to form, harden, and grind his own cutting tools. By helping the journeyman, he accumulates confidence in processing the job through the different operations required for its completion, and he is actually working on parts required for commercial use. Therefore, his responsibility is known to him and his interest increased.

The technical part of the apprenticeship of yesteryear is also to be preferred. The young man had to obtain that knowledge after working hours at night school, where he studied geometry, algebra, trigonometry, and finally mechanical drawing. After four years of schooling, plus his experience obtained in the shop, the young journeyman had a good foundation and was in a position to give his future employer full value for wages received. He also had a very good chance to become a master mechanic. These men are the backbone of industry and are badly needed in the future.

N. C. Thomsen
Denver, Colo.

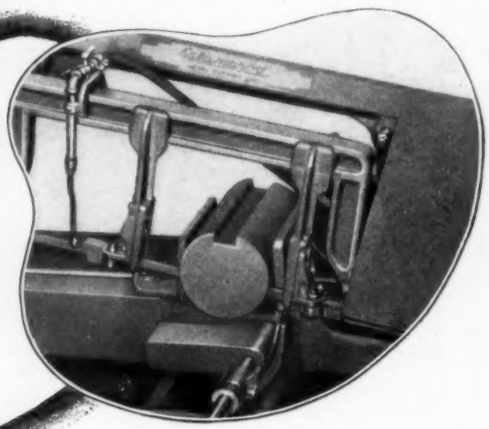
•

In my opinion, the apprentice of today is not taken seriously enough. Too frequently he is considered a handyman rather than a worker and ends up running errands, sweeping floors, or performing other menial chores around the shop that no one would dare ask of a regular shop man.

Further, today's apprentice isn't given the proper course of instruction. In my time, we were assigned a machine until we mastered it, with the result that when we were finished we knew thoroughly every machine in the shop. Under today's system, a man isn't given sufficient time on each individual machine and he ends up with a sketchy knowledge of all and a mastery of none.

It took four years before I was

CUTTING ACTION ALWAYS IN VIEW



You do not have to sit on the floor or throw your neck out of joint to check the cutting operation on the Kalamazoo Band Saw. Look right down into the cut—make adjustments while machine is operating.

Visibility is an important factor in accurate, fast, cut-off work—and the Kalamazoo provides a clear view of the job from the start to the finish of the cut.

Ask your dealer or write direct for complete information.

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Kalamazoo Tank & Silo Co., Kalamazoo 16, Michigan
IN CANADA—BRIDGE MACHINERY CO., MONTREAL

Kalamazoo *Metal Cutting* Band Saw

...with New A.C. Across-the-Line Magnetic Motor Starter

One button both starts *and* stops. Visual signal (operated mechanically) gives *positive* indication whether motor is ON or OFF.

These exclusive Master developments are just two of many that make this starter an outstanding engineering achievement. Chief among other features are clean, open design that makes the starter easy to wire; quick access to overload heaters and contacts from the front; sturdy straps (instead of flexible wire) as jumpers from overload relays to stationary contacts for extra rigidity to the entire assembly.

The start-stop single-button control feature with indicator flag is obtainable either integral with the starter or in a remote control station. Where multiple remote control of a single starter is required, the conventional two-button control can be furnished. For complete information on this new starter, simply write for Master Industrial Controls Bulletin No. 200, or get in touch with the nearest Master representative.

THE MASTER ELECTRIC COMPANY, DAYTON 1, OHIO

This new starter bears a trademark long famous on motors, assuring product integrity in control equipment as well.

MASTER

considered a first-class machinist, but that is only the beginning for a man who wants to call himself a toolmaker or diemaker. From then on, he is on his own, and it is up to him to make good. He has to go deeper into mathematics, learn to do things on his own initiative, and above all have complete confidence in himself and his machines. A man can't be coaxed into being a good tool or diemaker, he must drive himself into it.

Gosta Mattsson
Bronx, N. Y.

NEW BOOKS

WHAT IS INDUSTRIAL ENGINEERING?—*Published by J. D. Woods & Gordon Ltd., Industrial Engineers and Consultants, 15 Wellington St. West, Toronto, Canada. 74 pages. Free on request.*

Written to answer the question, "What does an industrial engineer do?", and to show the place of consultants in industry, the book covers industrial engineering in a general and fully understandable manner. Recurring throughout the book is the thought that industrial engineers have no cure-all for modern business ailments, but do possess training, experience and talent required for common-sense attack on business problems.

Their activities, as discussed in the book, include surveys; selling, merchandising and marketing analysis; cost, production and inventory control systems; records and procedures; training programs; time and motion study; incentive plans; and personnel selection, placement and job training.

Each of these phases, while not treated in as much detail as in the usual textbook, is developed by presentation of ideas, advantages and limitations.

•

PRACTICAL DESIGNS FOR DRILLING, MILLING AND TAPPING TOOLS—*By C. W. Hinman. Published by McGraw-Hill Book Co., 330 W. 42nd St., New York 18, N. Y. Second Edition. 416 pages. Price $4.50.*

War-time advances in tooling and the introduction of new, successful methods required publication of this second edition. Brought out first in 1938, the book has been revised extensively and adapted to the new tooling trends.

Intended primarily to reveal prin-

YOU CAN'T BE THAT LUCKY!

You can't expose ferrous metals to normal atmospheric conditions and not expect rust. Rust costs industry millions of dollars annually . . . a needless waste of labor and money. It is elementary that if you prevent air and moisture from coming into contact with the metal rust cannot occur. The important thing is to use a compound that gives you positive protection. A compound that stands the test of *all* weather conditions for an indefinite period of time.

DON'T GAMBLE! USE THE ONE AND ONLY NO-RUST

NO-RUST is the result of long and painstaking experimentation and testing. It does the job perfectly and economically. NO-RUST, for general industrial use, is a light bodied liquid which is easily sprayed or brushed. NO-RUST dries in a matter of minutes into a flint-like coating that is impervious to moisture or temperatures normally encountered. It will not peel, crack or chip for an indefinite period of time. NO-RUST is quickly removed with kerosene or distillate.

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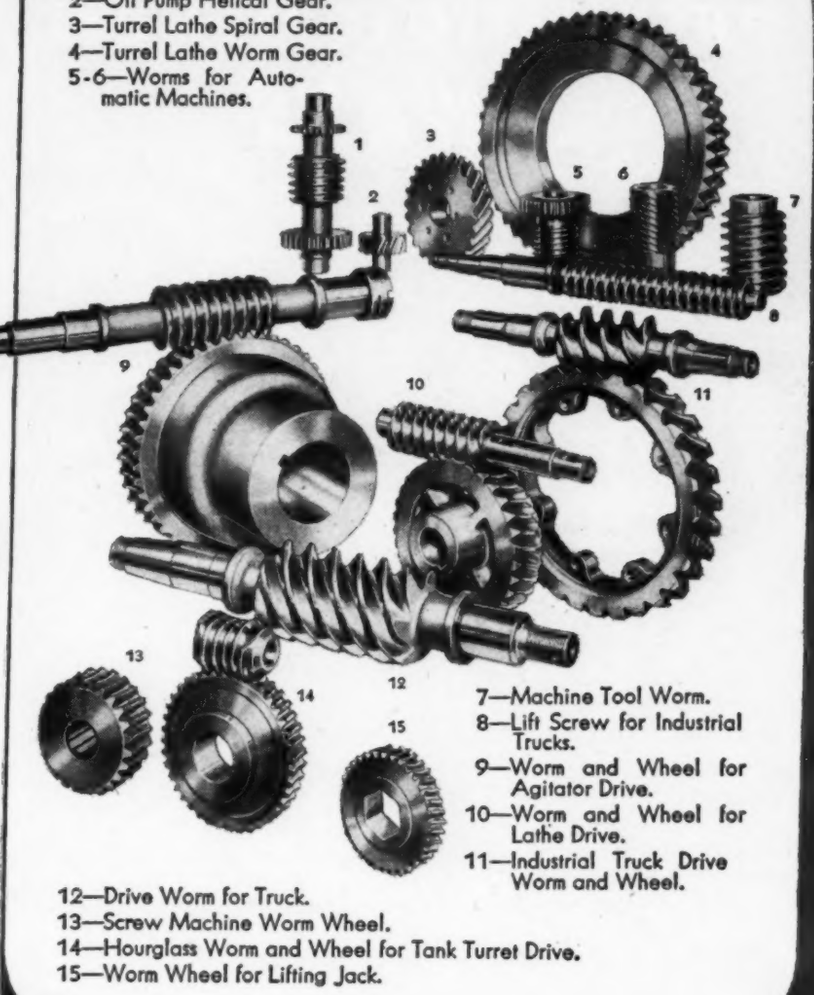
QUALITY *in Gears*



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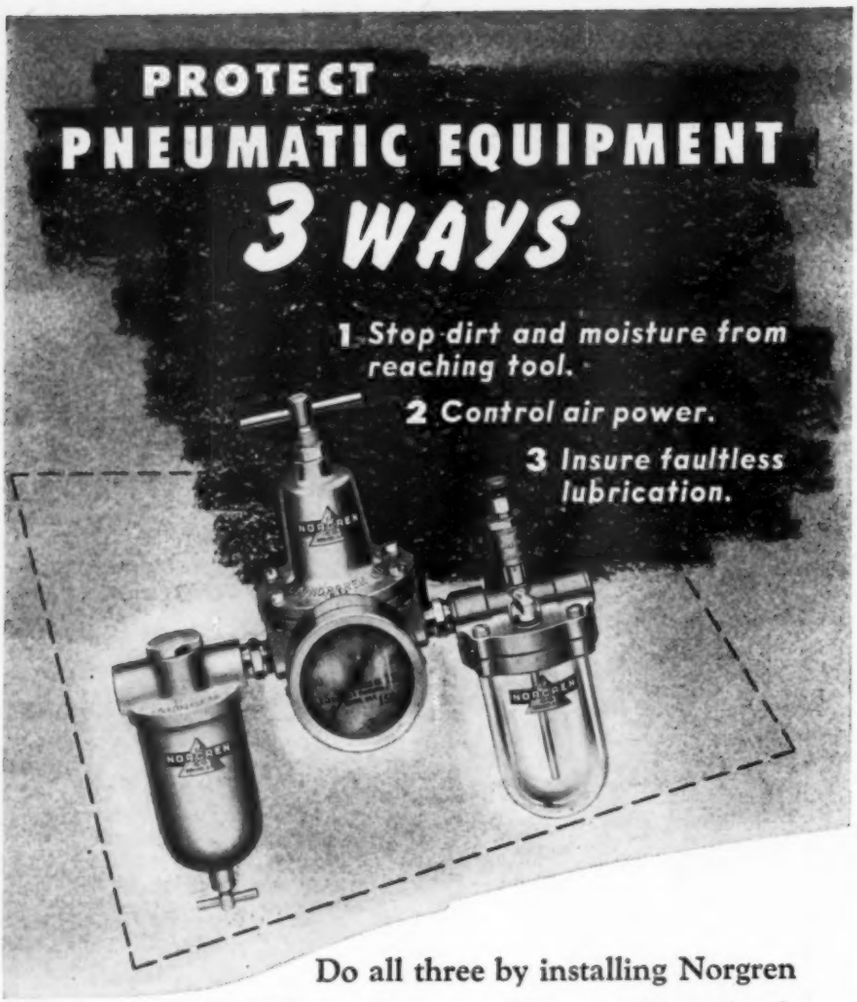

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ciples involved in the design of drilling jigs, milling fixtures and tapping tools and to show practical applications, the text has become a standard reference to the tool designer.

From the simplest to the most complex drill jigs are treated, among them being numerous types of commercial ones—jigs that permit repositioning the work for drilling holes closer together than usual, combination jigs, ejecting jigs and others. Four new methods of drilling holes in long sections of structural steel angles, stepped cutting points and hardened tool-steel drills are shown.

The milling section covers cam-operated fixtures, various cutter setups, negative-rake carbide cutters, climb-milling applications and the latest machines. The tapping section is extensive, showing air-controlled threading operations, automatic nut tapping, and many types of fixtures with detailed information on their design and sharpening methods for different kinds of taps.

Many tool-engineering tables are included on cutting speeds, tapers, twist drills, threads and part dimensions. A correlated list of visual aids recommends certain motion pictures and strip films that refer to tooling and machining practices.

•

STATISTICAL QUALITY CONTROL—*By Eugene L. Grant, Professor of Economics of Engineering, Stanford University. 563 pages. Published by the McGraw-Hill Book Co., New York 18, N. Y. Price $5.00.*

Dealing with the laws of probability and their application, the book is a working manual on the statistical techniques so widely used in industry to reduce costs and improve product quality. It is directed, not to the professional statistician or mathematician, but to quality-control engineers and other management personnel on whom rests the responsibility for producing with minimum cost and spoilage.

It treats fully the Shewart average, range, standard deviation, fraction defective and defects charts, with many practical examples and detailed analysis of each. Covered also are the theory of probability, the binomial as a probability distribution, Poisson's approximation and the Bayes' theorem.

Inspection, as related to quality control, is discussed fully, with special emphasis on quality assurance of sampling plans and acceptance procedures based on vari-

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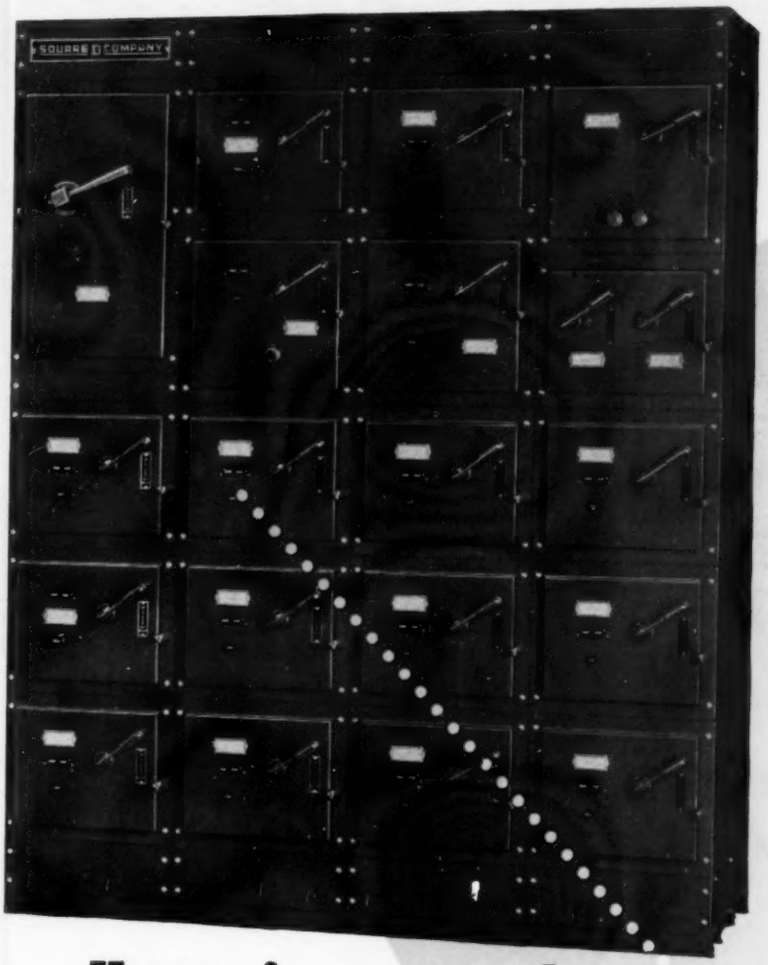

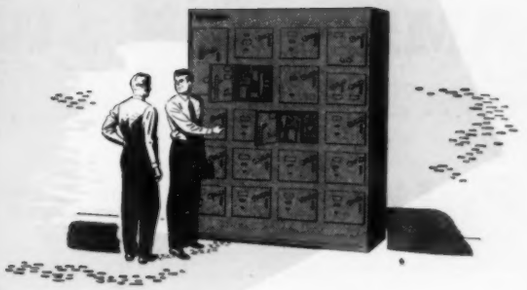

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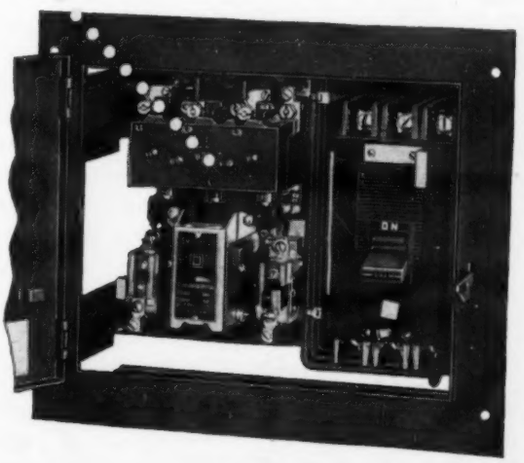

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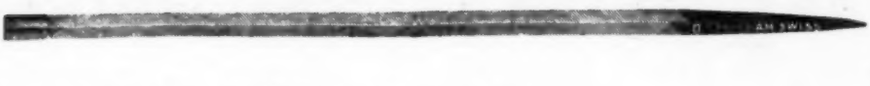

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able and attribute control charts. Excellent suggestions are given on making statistical quality control work. The cost aspects involved in a program are treated with practical examples that show how to arrive at an answer to the question, "Does it pay to use statistical quality control?"

Relation of top management to quality control is brought out by considering it, not as a system but as a set of tools—a special group of methods to be applied to problems of specification, production and inspection. Organization of the quality-control group as a body to use these tools effectively receives in the book its just consideration.

This text should become a top reference in the field of statistical quality control.

"Quotes"

Planning Today To Cut Costs Tomorrow

SPEAKING AT the Chicago Production Conference of the American Management Association, G. O. Clifford, technical director, Remington Arms Co., Inc., had this to say on cost reduction:

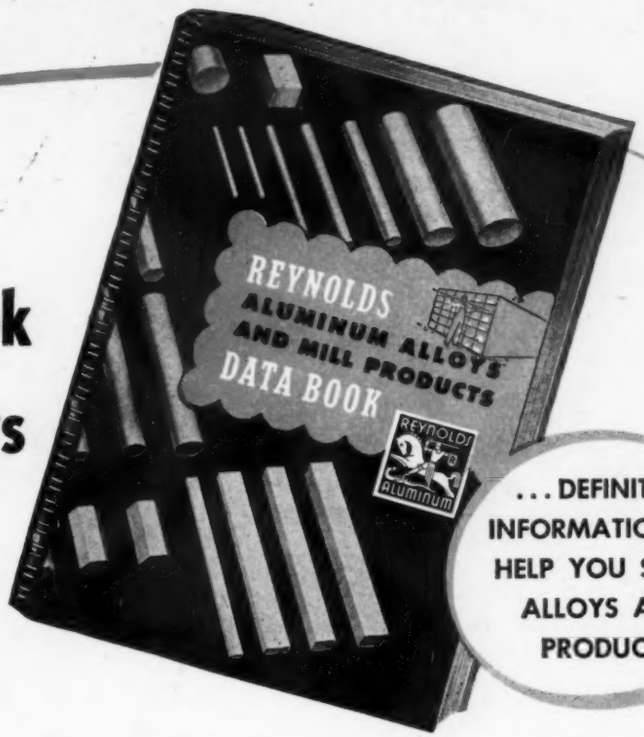
"Only by applying an integrated program of sound engineering and technology and competent planning today can we insure that tomorrow's operations will prove effective and profitable.

"Mechanical design has too often in the past regarded the metallurgist and the chemist as consultants only. Good design today requires perfect integration of mechanical, chemical, metallurgical and electrical design to obtain components of lowest cost and fine quality, which can be manufactured and assembled cheaply and safely with good industrial relations.

"In an effort to simplify assembly and reduce cost, emphasis has sometimes been placed on reducing the number of component parts required in an assembly. It is now recognized that the number and type of operations required to make the number of parts is a better index to relative cost.

"There is apt to be higher quality as well as lower cost in a product with fewer operations in spite of a greater number of parts than in a product with fewer parts but requiring more operations. In the latter

Just off the Press...



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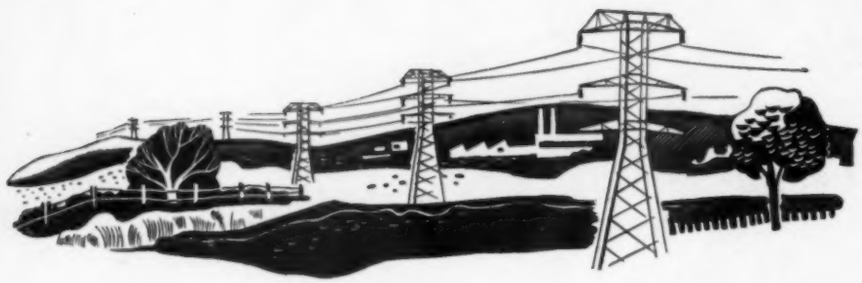

Billions of Kilowatt Hours are produced annually in Southern New England.

The high concentration of industry in Southern New England has resulted in a network of power facilities second to none in America. In this compact area, transmission lines are short and industry is assured of an adequate and dependable power supply at reasonable rates through numerous inter-connected feeder lines.

A well-integrated power supply is just one of the many industrial advantages to be found in Southern New England. For more facts on all the benefits available for your new plant location, write for the new booklet, "SOUTHERN NEW ENGLAND FOR TOMORROW'S INDUSTRY." Address: P. E. Benjamin, Mgr., Industrial Development, New Haven R. R., Room 201, 80 Federal Street, Boston 10, Mass.

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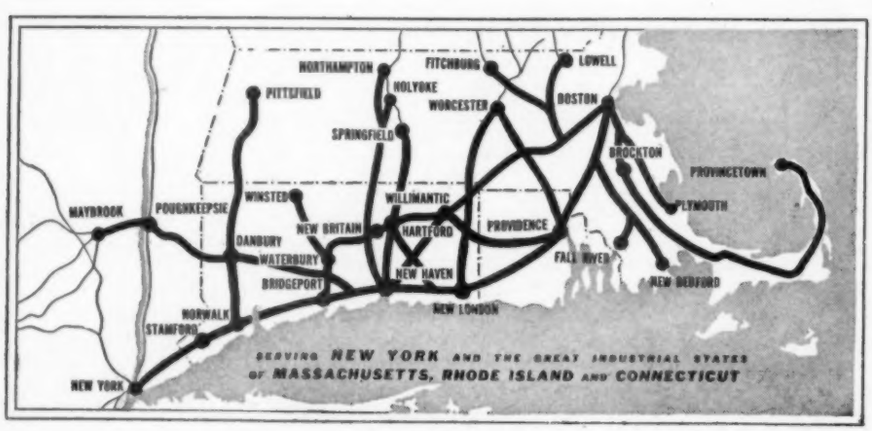


case, each part is relatively expensive because it is picking up costs at each operation and the production process is longer.

"As a result, if quality goes off at a later operation, there is a great temptation to let it go through in order to meet production schedules. This may entail higher cost on assembly and greater scrap loss. Frequently, these higher costs are not highlighted by our cost systems and only serve to turn up eventually as higher burden rates.

"A great deal more can be done by designers in the use of standardized parts for products. It is clearly a wasteful practice for designers in individual companies to be spending time designing components which have already been designed elsewhere and which might be available on sub-contract at much lower costs because of higher volune.

"The use of standardized specifications has been very effectively promoted by such organizations as The American Standards Association and its numerous member bodies. A number of the larger industrial companies have prepared very valuable manuals of design standards.

"I would like to see these made more generally available and more widely used. The use of standard components throughout a line of products has been very effectively exploited by the automotive industry. It offers an attractive possibility for much wider use throughout industry for lowest cost tomorrow."

•

The Freedom to Manage

WILLIAM B. GIVEN, JR., president, American Brake Shoe Co., speaking at the Chicago Production Conference of the American Management Association, said this about the "Freedom to Manage":

"In the middle twenties, more management authority began to be given to men below top ranks. The depression of the 1930's speeded up this trend. In our company we have carried the delegation and decentralization of management pretty far. We have developed what we call "bottom-up management" as differentiated from "top-down management."

"Under 'top-down management' the heads of a business do practically all the topside thinking and planning, and issue orders to those under them.

"Under 'bottom-up management' the head of the business, division or department, tries to release the thinking of every individual under

Fixed Nuts Stay Put–BUT

Even if your bolted assembly needs a fixed nut–remember that vibration and wear will loosen all other parts unless you use a strong spring washer to expand and hold all parts tight as wear occurs.

True, a good fixed nut will not move up or down on a bolt;–but the other parts of bolted assemblies inevitably loosen because of bolt stretch, the frictional wear of metal on metal, burrs, flares, and the pulverizing of paint, scale and rust.

A live spring washer–a long-range spring washer–is absolutely essential if you expect your whole assembly to be held tight as wear occurs. The expanding spring action keeps up the pressure on all parts as friction loosens them.

No matter what kind of nut you use–fixed or standard–be sure to specify a Kantlink spring washer. There is no substitute.

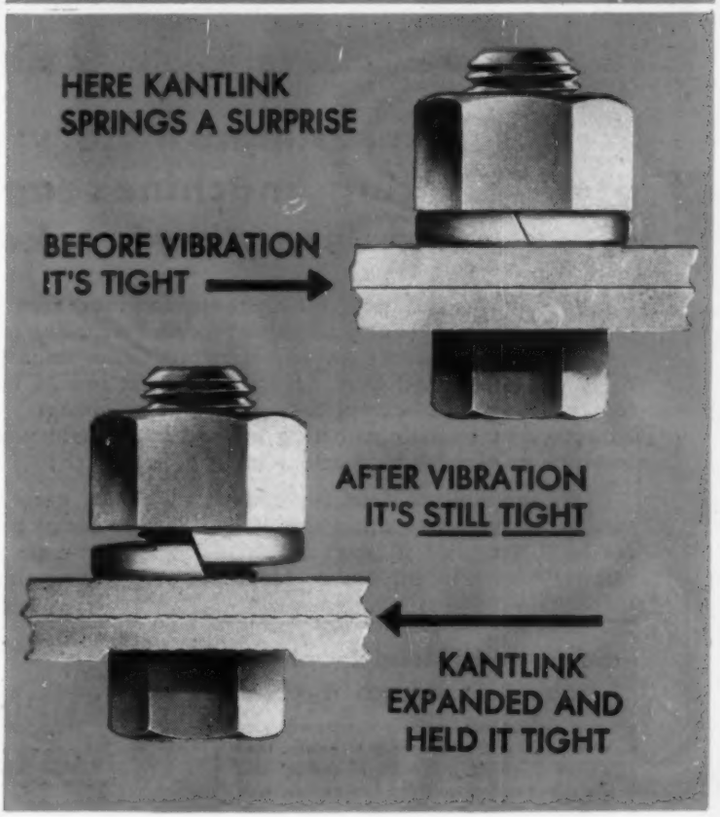
Originators of Kantlink the long-range spring washer.

Originators of

KANTLINK TRADE MARK

the long-range spring washer

Let's Spike the Nut to prove our Point
Here no Spring Washer is Used
BEFORE VIBRATION IT'S TIGHT
AFTER VIBRATION IT'S LOOSE
The Nut never moved— but the parts wore loose


HERE KANTLINK SPRINGS A SURPRISE
BEFORE VIBRATION IT'S TIGHT
AFTER VIBRATION IT'S STILL TIGHT
KANTLINK EXPANDED AND HELD IT TIGHT

THE NATIONAL LOCK WASHER COMPANY

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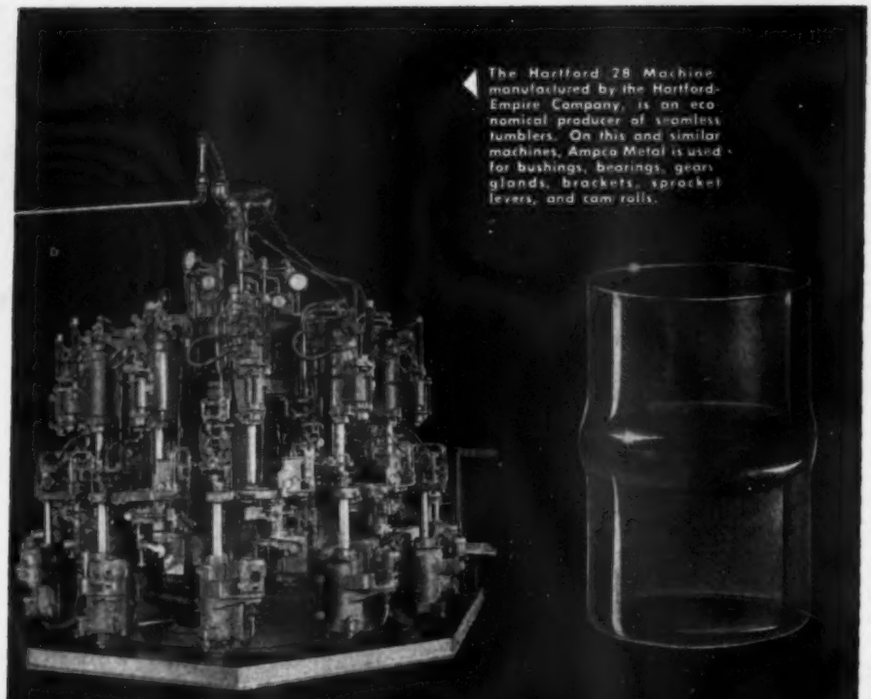
The Hartford 28 Machine manufactured by the Hartford-Empire Company, is an economical producer of seamless tumblers. On this and similar machines, Ampco Metal is used for bushings, bearings, gears, glands, brackets, sprocket levers, and cam rolls.

A machine needs *guts** to make a tumbler

Wear-resistant Ampco Metal protects glass-making machines against production-interrupting breakdowns

*"The manufacture of glass containers requires more from a machine than any other automatic production process," according to engineers at the Hartford Empire Company, Hartford, Conn., leading producer of glass-making machinery. "Equipment must run 24 hours-a-day, month after month except for mold and job changes. Add high temperatures, constant vibration and stress . . . and you have the ever-present threat of a machine breakdown.

"We use Ampco Metal for bushings, bearings, gears, and other vital parts subject to this punishment. Ampco Metal has the *guts* for hard wear and it won't corrode. It gives an extra margin of safety. We can install Ampco Metal parts and forget about them!"

Solve Your Metal Problems too, with Ampco Metal

Ampco Metal is the modern aluminum bronze — characterized by great strength, controlled hardness, corrosion resistance, and superior bearing qualities. Ampco Metal is available in seven grades and several modifications — can be produced by centrifugal or sand casting, extruding, or forging.

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him and to encourage personal initiative down through the organization. Ideas to improve products, to effect savings in money, motions or materials, to improve working conditions, in short to make a better company, flow *up* from below.

"Suppose we analyze the qualifications needed to succeed in a boss' job under 'bottom-up management.' What kind of man does it take?

"Without question, first, he must be the right kind of *person*—have the qualities you take for granted in a friend, be the kind of man you would enjoy working under, the kind who makes a good husband, a good father. There must be no quibbling here. If he isn't that kind of person, he must be relieved of management responsibility.

"Second, he must be a leader.

"Third, we preach that age, either young or old, is no handicap.

"Fourth, we believe, and try to practice — and it's harder than it sounds—that no job of itself fixes the salary rate. The man and his performance establish the rate.

"Fifth, the qualified boss must be realistic as to the basis of his relationship, and the company's, to the men who work with him. The old school of business managers felt that everyone who worked for them was in their debt. Some even felt that the worker's pay check was in part charity. Now we realize that every company has a long-term liability to those who contribute to its success. Managers who are not realistic as to this do not belong in today's management.

"Sixth, the leader must be a man who believes that the future in labor relations can be improved.

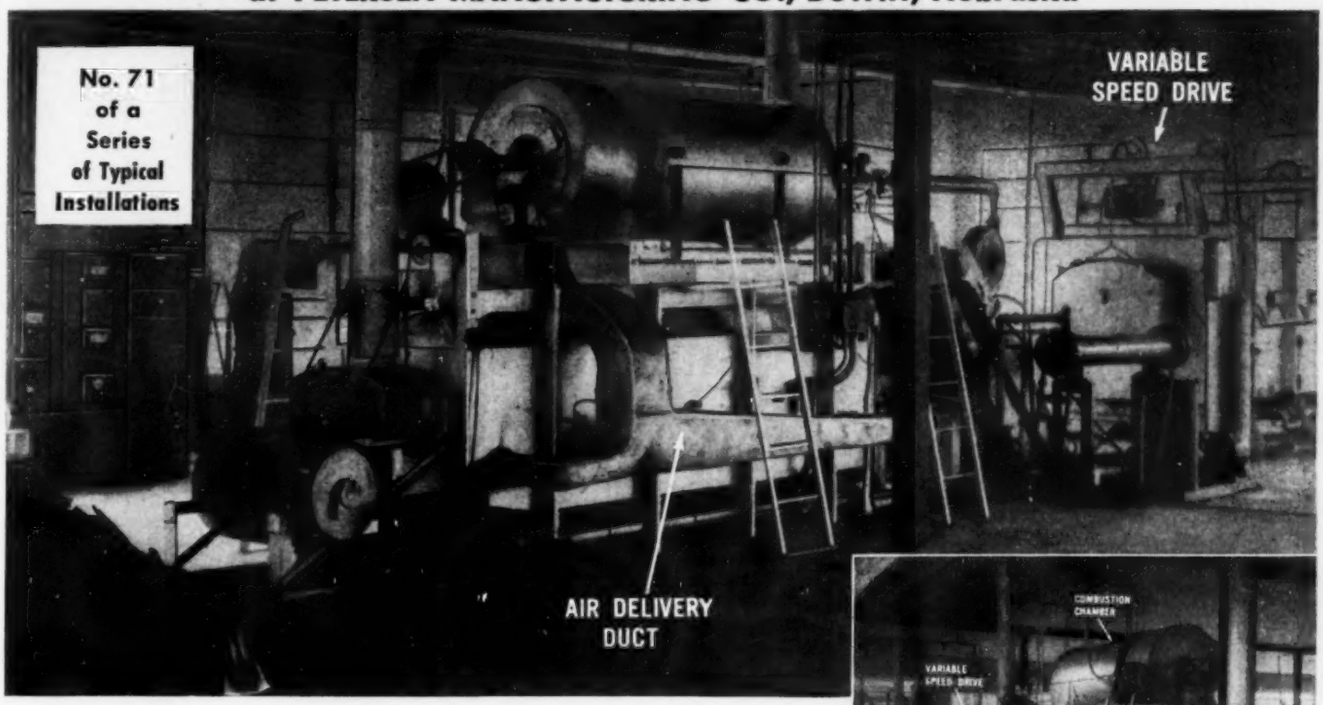
"Seventh, he must believe there is just around the corner a better way to do each and everything we do.

"We must give a great deal of time and thought to getting to know our people. This must have highest priority. We must stop thinking of them as union members, or as a group, and think of them as individuals.

"I wish and hope that more and more the push for freedom within management will come *up* from the lower ranks of supervisors. All of us are conscious of the great freedom given managements by directors—the top bosses. We must learn to *pass on* that freedom. In reverse, which is harder to practice, we must encourage supervisors of every rank to reach out for more power to 'run their show.' The degree of our success here will be the degree of our success in developing managers."

Sunbeam
STEWART
THE BEST INDUSTRIAL FURNACES MADE

For HEAT TREATING VISE-GRIP WRENCHES
at PETERSEN MANUFACTURING CO., DeWitt, Nebraska

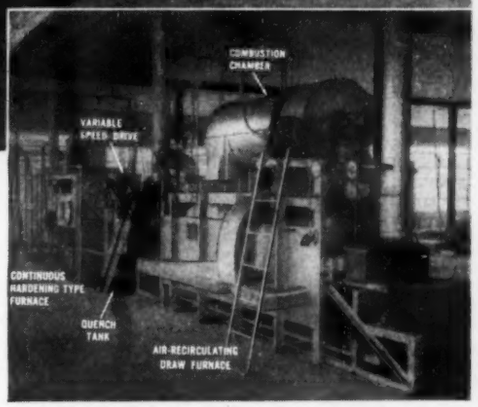


Sunbeam Stewart completely automatic heat treating unit consisting of a Continuous Hardening Furnace, Automatic Quench and Recirculating Air Draw Furnace used by Petersen Manufacturing Company in heat treating "Vise-Grip" wrench parts. This installation heat treats about 900 lbs. of wrench parts per hour.

Heat treating specifications for the well-known "Vise-Grip" wrench are high. The main wrench body must be heat treated to withstand a bending moment of not less than 4,000 lb. inches and the hardness reading on the jaws must be held within the range of 55 to 57 Rockwell C. To meet these production requirements, Petersen Manufacturing use a Sunbeam Stewart continuous conveyor type Hardening, Quench, and Draw Furnace that heat treats about 900 lbs. of wrench parts per hour.

The Sunbeam Stewart continuous conveyor type Hardening Furnace is overfired, automatically controlled, employing an alloy belt to carry the work through the heating zone and automatically discharging into either an oil or water quench. After quenching, the products are removed by conveyor from the quench tank and discharged onto the draw furnace belt. The draw furnace is a Sunbeam Stewart Air-recirculating type having a maximum operating temperature of 1250° F. A large capacity fan recirculates the combustion gases through the work from 30 to 40 times per minute, depending upon the amount of load.

This completely automatic installation is typical of the industrial furnaces Sunbeam Stewart engineers are building every day to meet the specified requirements of manufacturers all over the continent. In addition, Sunbeam Stewart builds a full line of standard furnaces.



Discharge end of Sunbeam Stewart continuous type Hardening, Quench and Draw Furnace. Main wrench body of the famous "Vise-Grip" wrench is heat treated to withstand a minimum bending moment of 4000 lb. inches.

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SUNBEAM STEWART VEST POCKET HEAT TREATING DATA BOOK

Seventy-two pages of charts, tables, diagrams, factual data . . . ready reference book for all types of engineers. Write Sunbeam Stewart, Dept. 119, for your personal copy.

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A letter, wire or 'phone call will promptly bring you information and details on SUNBEAM STEWART furnaces, either units for which plans are now ready or units especially designed to meet your needs. Or, if you prefer, a SUNBEAM STEWART engineer will be glad to call and discuss your heat treating problems with you.

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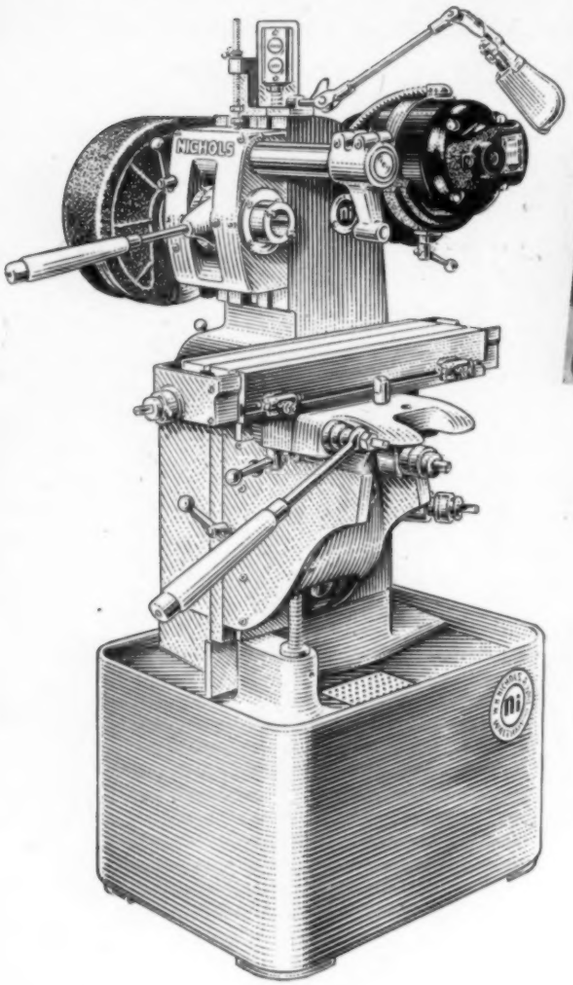

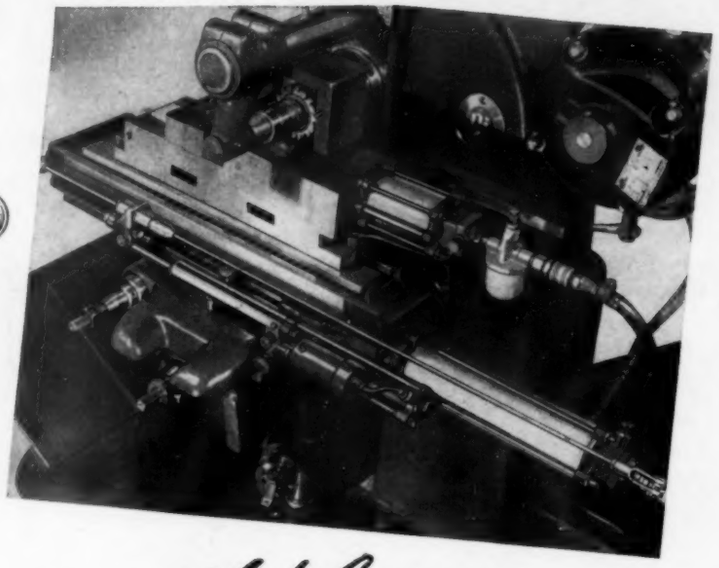

the Nichols Miller

The new and proven power feed attachment substantially increases the value of any Nichols Miller as a production machine — yet does not limit its capacity as a tool room producer. The power feed is entirely automatic — the operator merely has to load and unload pieces and can, with ease, run two or more millers.

The power feed attachment is a Bellows air feed unit combined with a Hydro check. The design has several advantages. It gives a positive, but infinitely variable feed through the 6" maximum cutter stroke. Table advance and return are fast, and shut-off is automatic. It means the attachment is versatile — suited to any class of job within the capacity of the miller. The unit operates on regular shop air lines with 75 to 175 lbs. pressure.

Nichols Millers are famous for their precise production of tool room parts. Now, with the addition of power attachments, output can be multiplied to a mass production scale while tolerances are held to "tenths". Write today for complete details on this profit making attachment.

CONDENSED SPECIFICATIONS

Table Working Surface	6¾" x 21" or 30"
Longitudinal Travel (screw or lever)	10" or 19"
Transverse Travel (screw or lever)	7"
Vertical Travel — Knee	13½"
Rise and Fall of Spindle	4½"
Selective Speed Ranges up to 5000 R.P.M.	
Weight	1250 lbs.

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THE Nichols MILLER

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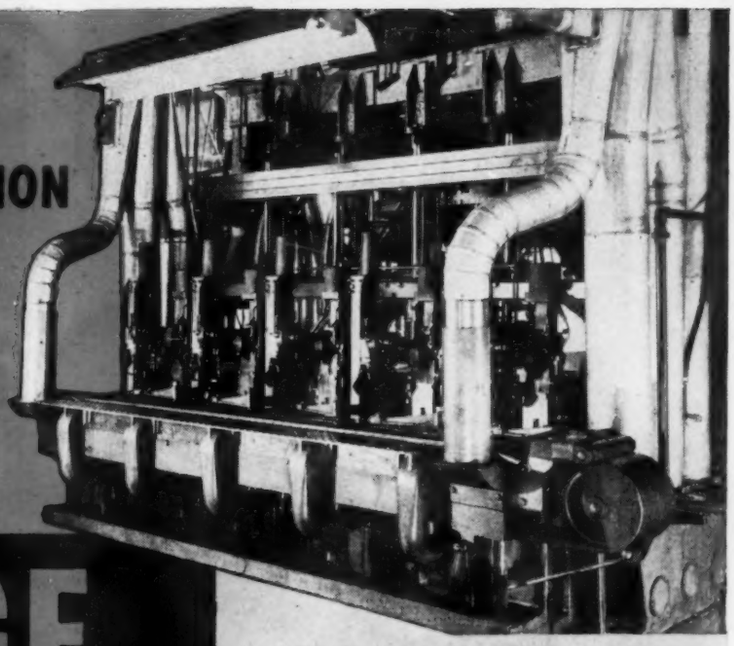
NATIONAL DISTRIBUTORS: NICHOLS-MORRIS CORP., 40 CHURCH ST., NEW YORK 7, N. Y.

HERE'S A VERTICAL APPLICATION THAT'S A "NATURAL" FOR THE *New*

ORANGE *Cage Type* NEEDLE BEARINGS

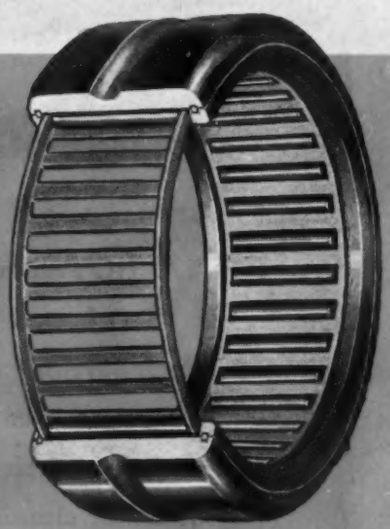


In HARTFORD-EMPIRE BOTTLE MAKING MACHINES, the vital Mold Holding Supporting Mechanism runs on Orange Cage Type Needle Bearings. They are serving in this vertical application with great satisfaction and contributing materially to the long, trouble-free life of these great machines.

DESIGNING ENGINEERS have been waiting for a needle bearing especially adaptable for spindles and high speed applications; that could be used in *vertical* or *overhung* applications; and be less affected by misaligned mountings.

The new Orange Cage Type Needle Bearings are the solution to these punishing operations. The big reason is found in the exclusive cage design which maintains permanent alignment of rollers with precision-ground raceways. As a result, there is no skewing of rollers—less internal friction—smoother, quieter running—longer life hours expectancy. The superior "cage type" advantages make these Orange Bearings ideal for practically all needle bearing applications.

Orange Cage Type Needle Bearings are made in a wide range of standard types and sizes. Send for Engineering Data folder giving full details. Consult our engineers on any application.



● Cross-section shows square-end rollers in coined pockets of free-rolling cage, made of anti-friction, non-ferrous metal. Internal clearances can be controlled to meet exacting specifications. All rollers and raceways "Pentrate" finished.

ORANGE ROLLER BEARING CO., INC.
554 Main Street, Orange, N. J.

ORANGE ROLLER BEARING CO., INC. AM
ORANGE, NEW JERSEY

Gentlemen:

Please send me Engineering Data on new Cage Type Needle Bearings.

Name.....Title.....
Company.....
Address.....
City.....State.....

Removing carbon and other residue from motor after testing special lubricants.

Photographs courtesy of the Lubrizol Corporation

All laboratory equipment must be free from all foreign materials. Osborn brushes keep them clean.

Better Oils — FROM BRUSHES!

WHO ever heard of brushes making oil better? Lubrizol Corporation, which develops addition agents that improve petroleum products uses Osborn brushes in their Wickliffe laboratories for motor cleaning jobs where the condition of gears and other moving parts must be precision-exact, so that properties of specially-treated lubricants can be observed. In the chemical laboratories, Osborn Monitor wheels have proven the fastest and most efficient method for removing corrosion from copper and brass laboratory equipment. And so on through the plant.

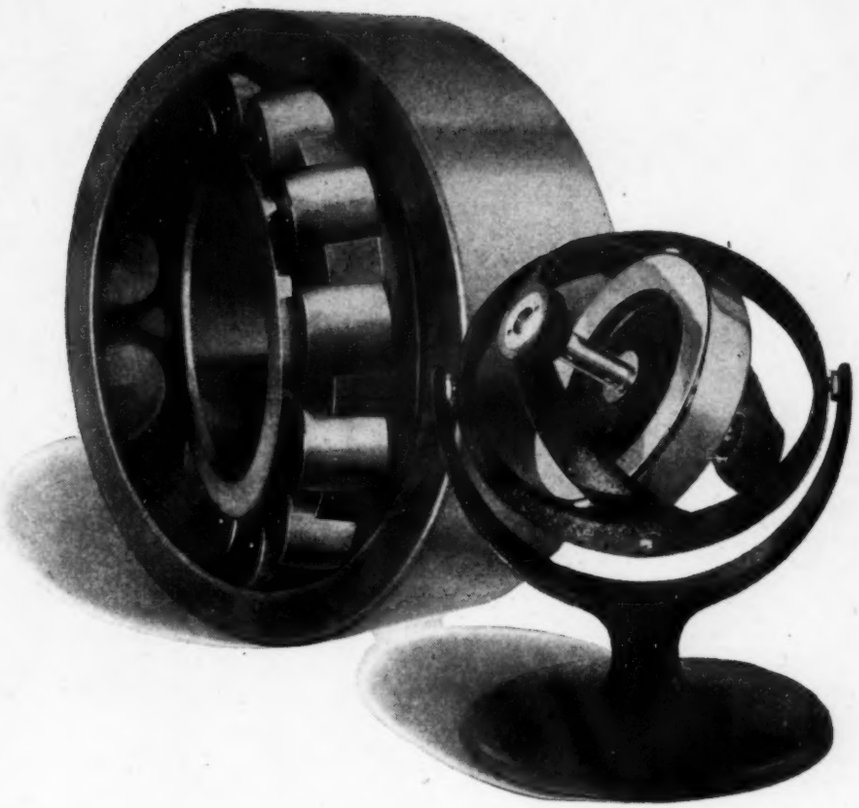
No matter what you make—oils or engines; teapots or telephones—modern brushing techniques as developed by Osborn, can help you turn out your product faster, cheaper and better!

This has been proved true in industry after industry. Let us prove it to you—without obligation, of course. Dictate that note or write that card to Osborn—today!

THE OSBORN MANUFACTURING COMPANY
5401 Hamilton Ave. *Cleveland, Ohio*

Osborn Brushes

WORLD'S LARGEST MANUFACTURER OF BRUSHES FOR INDUSTRY



Operating stability...

is characteristic of both the gyroscopic rotor and the Torrington *Spherical* Roller Bearing. Despite shaft deflection or misalignment, the self-aligning feature of the *Spherical* Roller Bearing

Assures sustained load capacity...

since the full area of bearing contact surface is maintained between rollers and spherical outer race bore. This feature of the *Spherical* Roller Bearing is responsible for its long, efficient and adjustment-free operation in many heavy-duty machines.

Check this and many other advantages of the Torrington *Spherical* Roller Bearing against the requirements of *your* installation. Write today for a copy of our Bulletin #200.

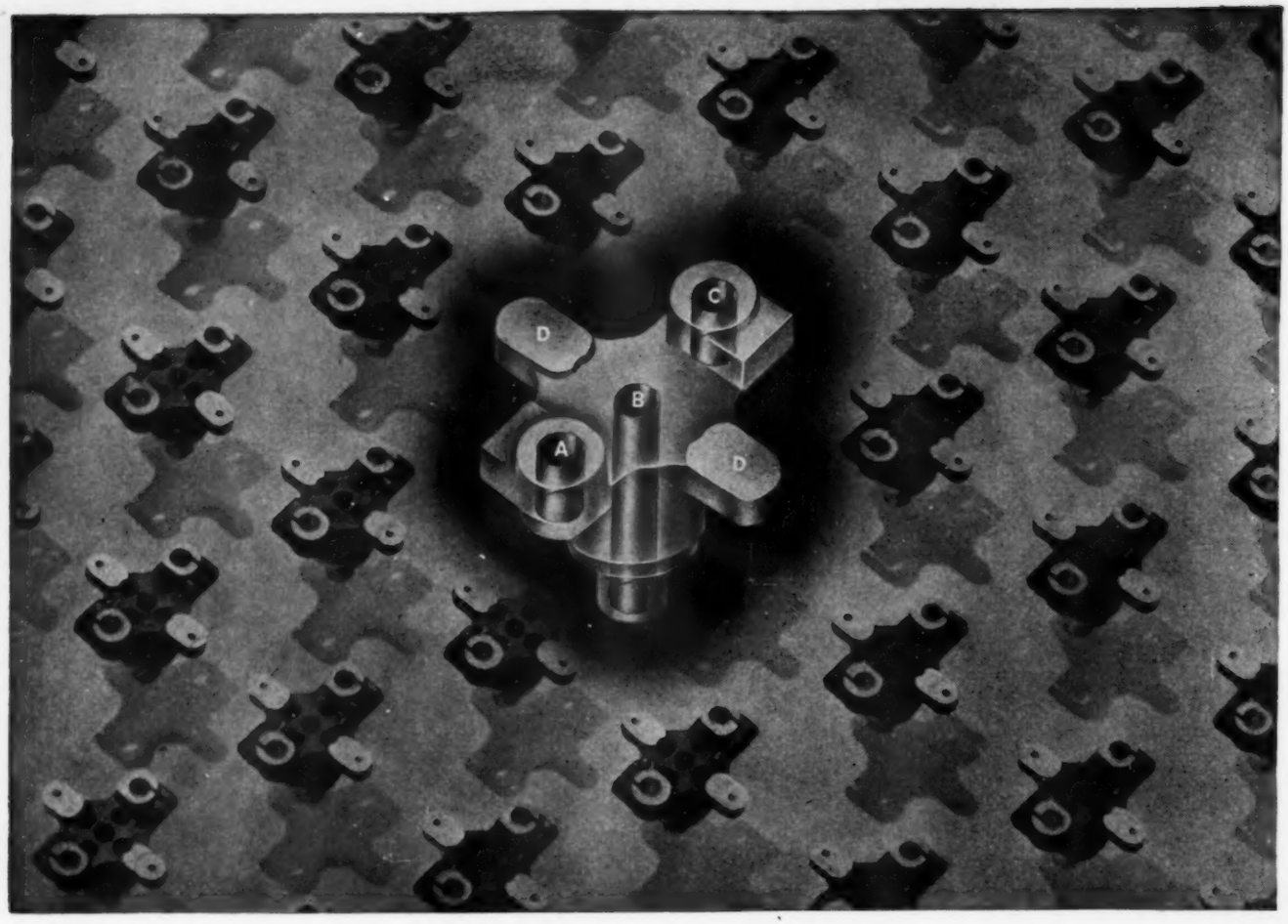
THE TORRINGTON COMPANY

SOUTH BEND 21, IND. TORRINGTON, CONN.

Offices in All Principal Cities

TORRINGTON BEARINGS

• NEEDLE • SPHERICAL ROLLER • STRAIGHT ROLLER • TAPERED ROLLER • BALL •



How to use the *Moore Jig Borer* as a Production Machine

Three holes located and sized, two pads milled—in a single set-up; 5,000 aluminum parts—6 minutes each. Are you limiting the capacity of your jig borer by using it only on toolroom work? You needn't... if it's a Moore Jig Borer.

For this versatile machine not only adds toolroom accuracy to your production jobs but often outperforms special-purpose machines. Here's proof on a run of 5,000 aluminum parts:

Holes A, B and C were located to a tolerance of .0005", sized to + .0005",—.0000"...had to be parallel to .001" checked on plugs 1" long...two pads D milled to ±.001".

In order to hold these pads in close relation to the holes, the job was done in a single set-up.

A drill jig couldn't handle such close tolerances; reamers and bushings would wear. Since aluminum is not free-machining, a good finish would be difficult to obtain with reamers.

The only answer was single-point boring. After the holes were roughed out with a jig costing $75, the Moore Jig Borer machined them to exact location and size. The entire operation, including the machining of the two pads, required only six minutes each and reduced appreciably all previous costs.

Such speed and accuracy are the result of the Moore Jig Borer's sensitive spindle which provides speeds to 2,600 RPM, and quick-setting lead screws. The latter, ground to an accuracy of .0002" in 16", enables you to spot, drill, bore and ream holes in one set up, with minimum tool changes.

Remember this versatility when you specify your next jig borer. Meanwhile, write for illustrated literature.

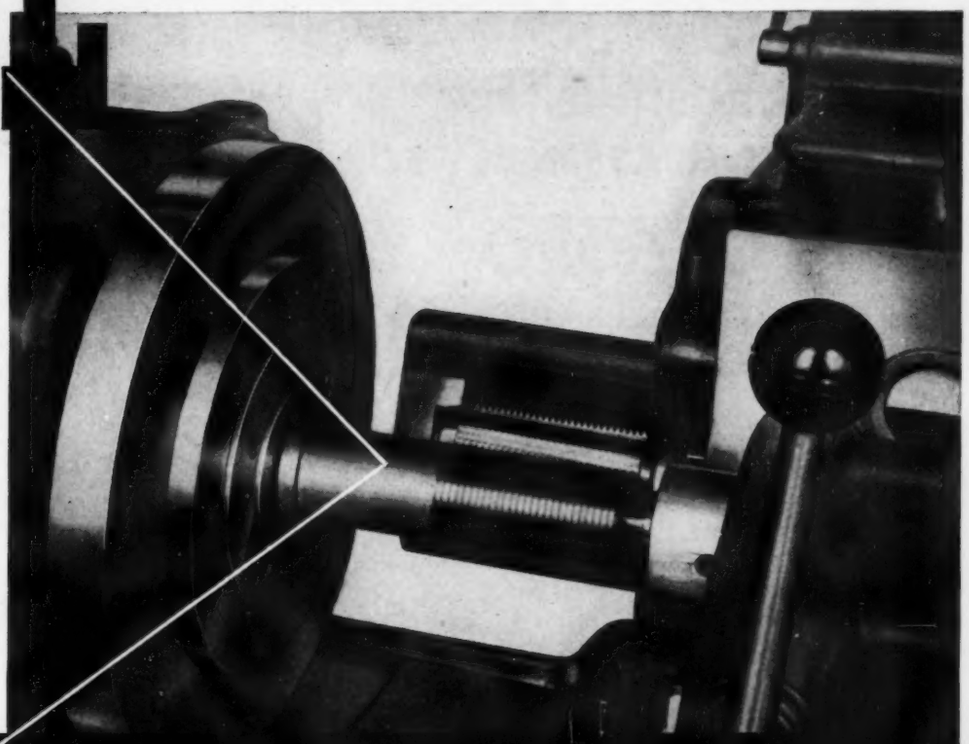
MOORE SPECIAL TOOL CO., INC.
738 UNION AVENUE, BRIDGEPORT 7, CONN.

MOORE JIG BORER

MOORE TOOLS

SPOTS, DRILLS, BORES, REAMS...WITH MINIMUM TOOL CHANGES

ONE REVOLUTION IS ENOUGH



FOR MILLING THREADS WITH A HANSON-WHITNEY MACHINE

In these days of rising costs, Hanson-Whitney is leading the way to more economical thread production . . . to simplified set-up and operation . . . with the very latest thread milling equipment. Internal or external threads; right or left hand threads; straight or tapered threads are produced automatically in one revolution with a multiple thread milling cutter. That means more volume in a given time . . . less time on a given job. Whether you handle small lot or mass production jobs, Hanson-Whitney engineers can show you how to realize direct savings from lower equipment costs, from reduced maintenance, and from lower labor costs. For further information, write: The Hanson-Whitney Machine Company, Hartford, Conn.

Hand it to

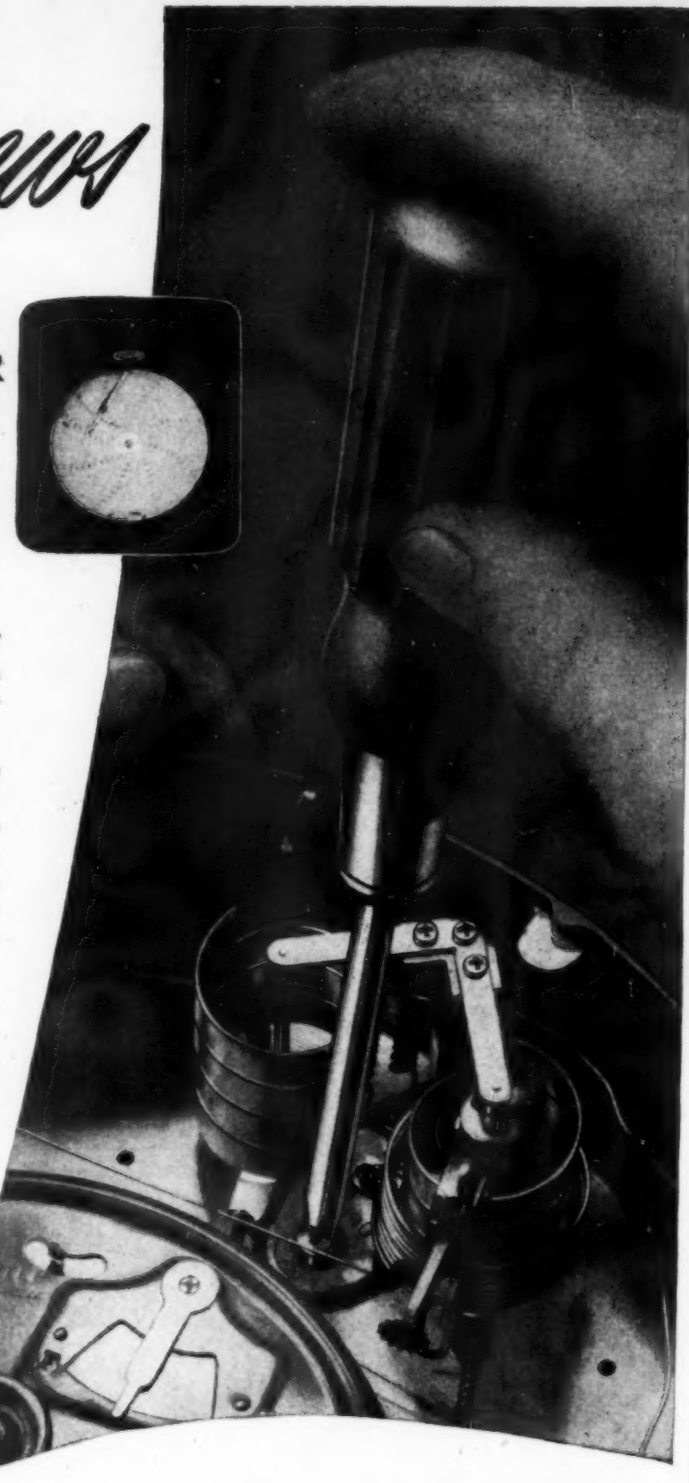
Hanson Whitney

MACHINE COMPANY

HARTFORD • CONNECTICUT

Phillips Screws

GIVE POSITIVE "FIX" ON CRITICAL ASSEMBLY FOR FOXBORO



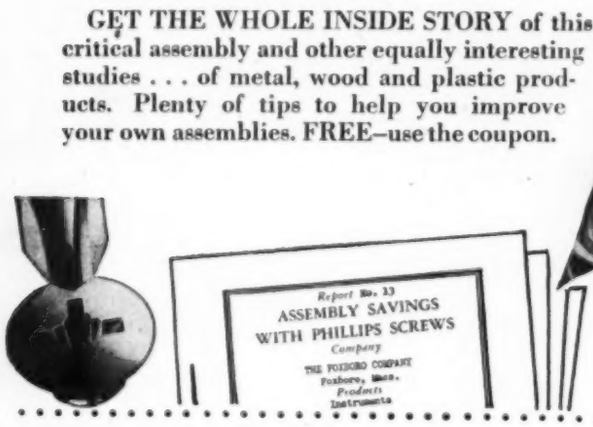
High spots from independent investigator's on-the-scene report . . . another study of assembly methods in key industrial plants by James O. Peck Company.

● "We gave Phillips Screws a big responsibility," Foxboro's chief engineer explained, "to maintain an accurate alignment of the helical coils in our temperature recording and control instruments.

"PHILLIPS' POSITIVE DRIVE makes positive fastening easier, more certain. Five Phillips Head Screws hold in accurate position the helical coils which are the heart of these instruments. The four-point contact of the driver in the Phillips recess makes it easy for the assembler to start the screws and drive them home. And we can depend on them to hold securely despite vibration or shock.

"WE SAVE DRIVER SLIPS that would cost us up to $50 apiece. This is a tight-spot assembly where the slip of a driver – a constant hazard when driving slotted head screws – would irreparably damage the delicate capillary tubes, less than a half-inch away. The cost of such a slip – disassembly, replacing the damaged element, and reassembly – runs up to fifty dollars."

GET THE WHOLE INSIDE STORY of this critical assembly and other equally interesting studies . . . of metal, wood and plastic products. Plenty of tips to help you improve your own assemblies. FREE—use the coupon.



Phillips Screw Mfrs., c/o Horton-Noyes AM-14
2300 Industrial Trust Bldg., Providence, R. I.

Send me reports on Assembly Savings with Phillips Screws.

Name .....

Company .....

Address .....

PHILLIPS *Recessed Head* SCREWS

Wood Screws • Machine Screws • Self-tapping Screws • Stove Bolts

24 SOURCES

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Chandler Products Corp.
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Pheoll Manufacturing Co.
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Russell Burdsall & Ward Bolt & Nut Co.
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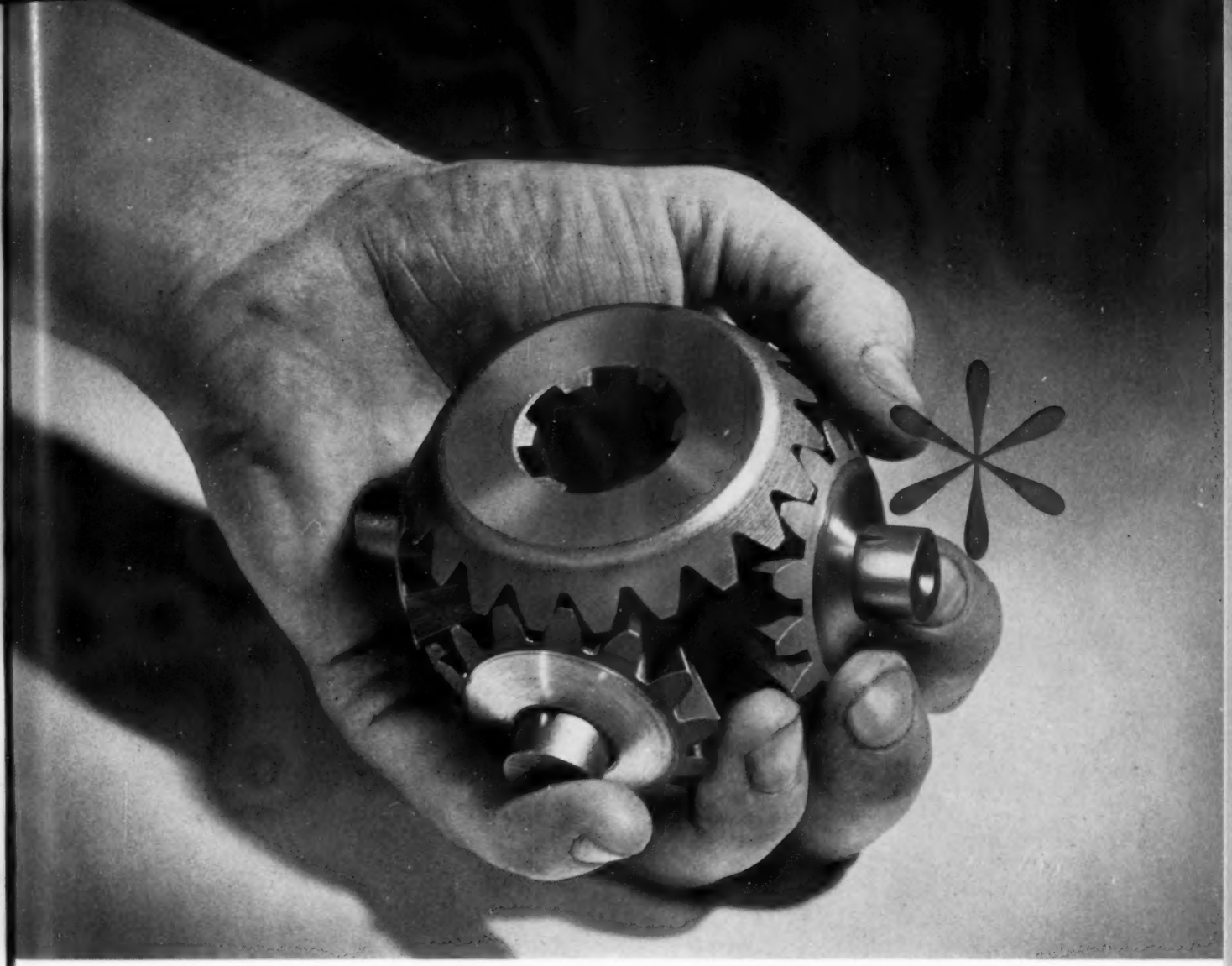


* How to raise gears to live and work together

Here's a pair of twins and a set of "quads" born and raised to live long and work well as a team. They come from a long-lived family of products that has earned a reputation for staying on the job. "Double Diamond" is the name.

No one factor is responsible for this. Rather it is the hard day-to-day job of holding to one set of standards in *all* manufacturing processes. Each individual Double Diamond employee knows that his job is just as important as any other to the performance of the final product. That's our idea of the way to make gears. And if gear performance has a bearing on the performance of your products, on the integrity of your trade mark, we'd like to do business with you.

A letter or phone call will place our engineering department at your service.

DOUBLE DIAMOND
TRADE MARK
GEARS

Made by
AUTOMOTIVE GEAR WORKS, INC.
RICHMOND, INDIANA

FOR AUTOMOTIVE, FARM EQUIPMENT AND GENERAL INDUSTRIAL APPLICATIONS

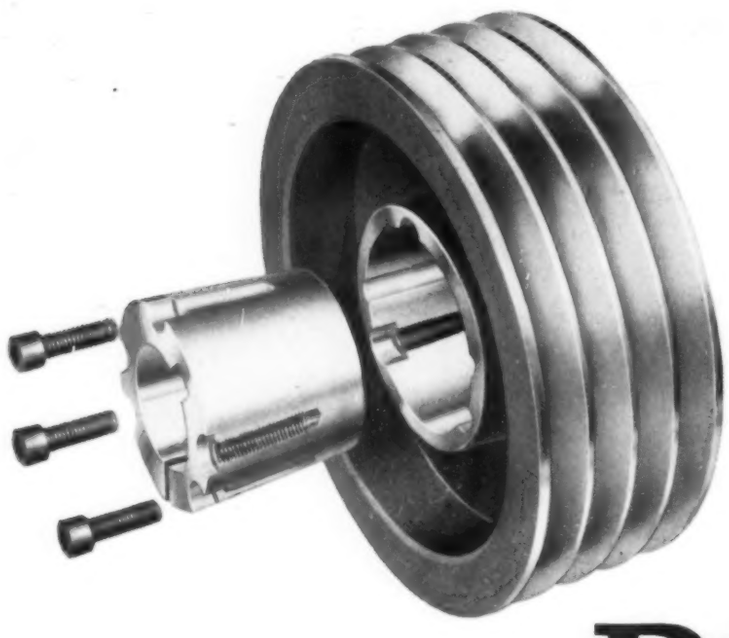
The simplest, surest mechanism ever devised for holding wheels to shafts.

Complete unit. Slip it on, line it up and tighten while sighting.

TAPER-LOCK BRAND

A New Cost-Saving Taper Bore Sheave

Holds fast to the shaft with firmness equivalent to a shrunk-on fit.



Disengages with less effort than any other sheave. Easy on. Easy off.

Complete range of sizes in Dual Duty (A and B); B, C and D grooves.

DODGE

of Mishawaka, Ind.

For details about cost-saving developments in power transmission equipment, call the Transmissioneer—your local Dodge distributor. He's factory-trained, qualified to suggest ways to improve machine performance and increase production. Look for his name under "Power Transmission Equipment" in your classified telephone directory.

DODGE MANUFACTURING CORP., MISHAWAKA, INDIANA

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NAME PLATES

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, ETCHING COMPANY OF AMERICA, 1520 MONTANA STREET, CHICAGO 14, ILLINOIS

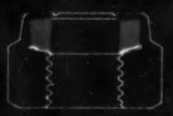
THE FAMOUS *Red Elastic Collar* IS A SYMBOL OF SECURITY

The RED ELASTIC COLLAR is . . .

PERMANENTLY CLINCHED to prevent turning under application and subsequent operational stresses.

PERMANENTLY SECURE against vibration effects. The bolt impresses (does not cut) full contact threads.

PERMANENTLY TIGHT against moisture. Bolt threads have 100% contact in collar — and a full metal seat.



REUSABLE. The Red Elastic Collar retains its grip after repeated usage.

It makes ESNA *Elastic Stop Nuts Self-Locking, Self-Sealing and Reusable*

As a result, all ESNA Elastic Stop Nuts protect assemblies against the effects of: VIBRATION: Elastic Stop Nuts lock in position anywhere on a bolt or stud. Vibration, impact or stress reversal cannot disturb prestressed or positioned settings. . . . CORROSION: Elastic Stop Nuts keep the working threads on the bolt and nut bright and rust-free to protect their strength and permit easy removal without damage to the bolt. . . . THREAD FAILURE: Elastic Stop Nuts dampen impact stresses and materially reduce the shocks against bolt threads that frequently cause metal fatigue. . . . LIQUID SEEPAGE: Elastic Stop Nuts produce a radial-reactive pressure against the bolt threads inside the Red Elastic Collar that makes Elastic Stop Nuts self-sealing against liquid seepage. . . . COSTLY MAINTENANCE: Elastic Stop Nuts are reusable. (Torque tests on aircraft bolts prove that adequate locking torque is maintained through 15 on-and-off cycles.) They do not deform the bolt, damage the threads, gall the finish, or rust.

This wide range of protection permits full purchasing and inventory standardization and its resultant economy. For further information address: Elastic Stop Nut Corporation of America, Union, New Jersey. Sales Engineers and Distributors are conveniently located in many principal cities.

ESNA ELASTIC STOP NUTS

TRADE MARK

INTERNAL WRENCHING

ANCHOR

WING

SPLINE

CLINCH

GANG CHANNEL

CAP

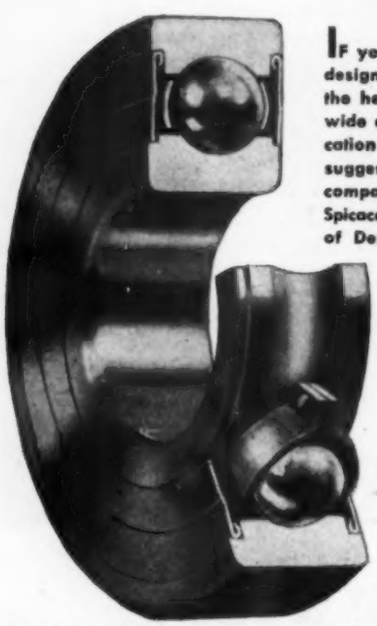
PRODUCTS OF: ELASTIC STOP NUT CORPORATION OF AMERICA

Something to sell

IF you are one of the forward looking manufacturers who are planning NOW for 1948 when improved design will be a necessary part of your selling in a more competitive market, then we have something to sell you.

It's ball bearing know-how—brains and experience to work with you on the design of your machinery to make the best practical use of anti-friction ball bearings.

Because we are small enough to want to grow and big enough to offer complete facilities and ample future capacity, we are good people to talk to NOW, work with on present plans, tie-up with when you must meet competition with sleeves-rolled-up in the future.



IF you have any long range design planning which requires the help of an engineer with wide experience in the application of ball bearings, we suggest that you write to this company, Attention Mr. A. R. Spicacci, Chief Engineer in charge of Design and Development.

BEARINGS COMPANY OF AMERICA • LANCASTER, PA.

BCA RADIAL · ANGULAR CONTACT · THRUST **BALL BEARINGS**

ALLEN TRU-GROUND DOWEL PINS

support accurate tool and die work

They serve as locating pins for the diemaker's work — and then go on to general duty as pins and pivots in various machine assemblies. By their accuracy and strength they *retain* precision standards in tool and die assemblies under punishing stresses.

They are ground to a limit of .0002″ over basic size, with an allowable tolerance of plus or minus .0001″. Surfaces are finely polished; subsequently treated with a rust-preventive.

Metallurgically in a class with ALLEN Hex-socket Screws:— made of the same special-analysis *ALLENOY* steel, heat-treated to an extremely hard surface, with a core of the right toughness to prevent "mushrooming" when driven into a tight hole... Tensile strength, 240,000 to 250,000 lbs. per sq. inch... Typically the Allen high safety-factor in HOLDING-POWER.

Ask your local ALLEN Distributor for samples and dimensional data . . . the same Distributor who serves you dependably with Allen Hex Socket Screws and other first-call mill supply items.

TRADE A MARK

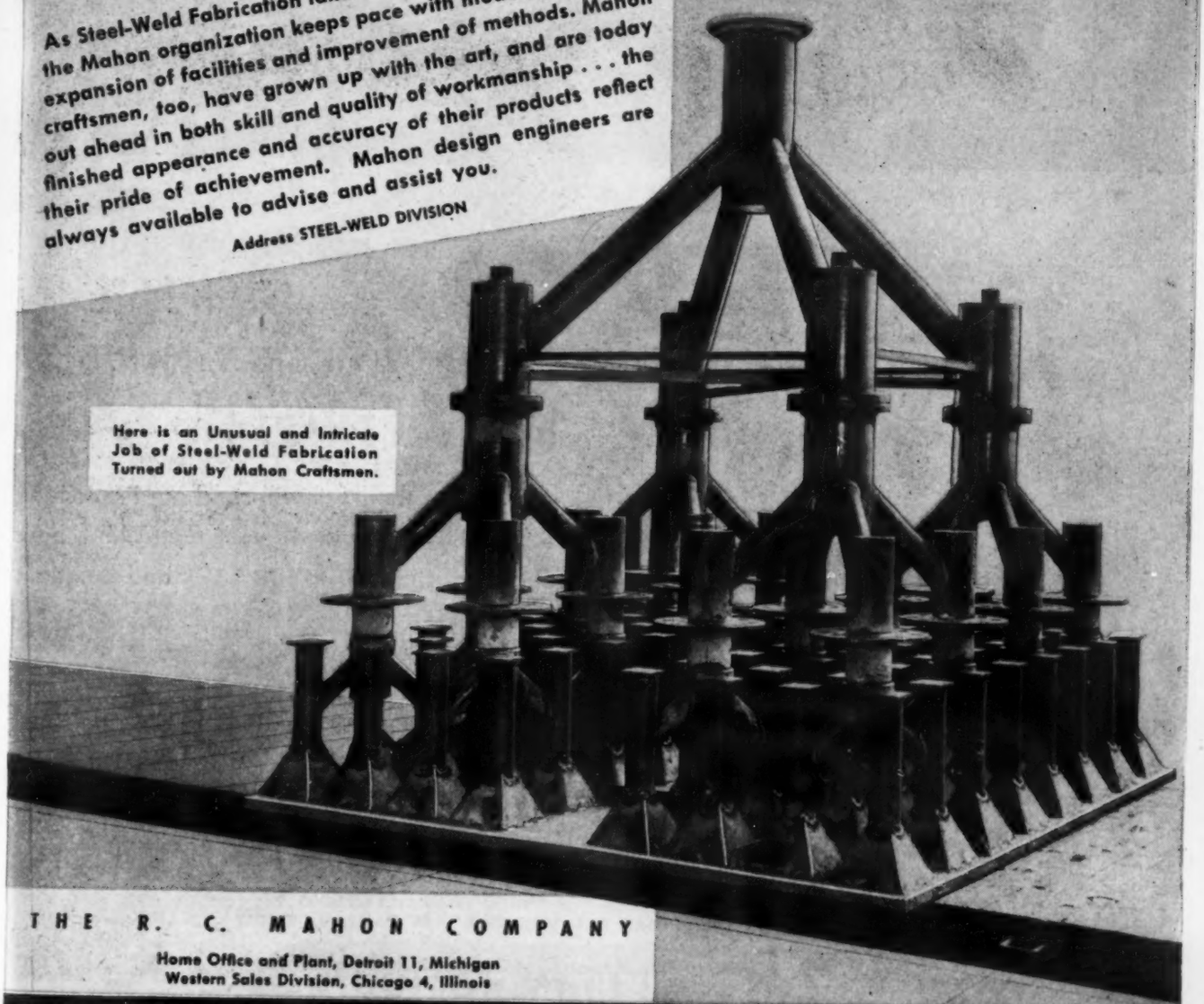
THE ALLEN MANUFACTURING COMPANY

HARTFORD 1, . . . CONNECTICUT, U. S. A.

Steel-Weld FABRICATION

As Steel-Weld Fabrication takes its rightful place in industry, the Mahon organization keeps pace with modernization and expansion of facilities and improvement of methods. Mahon craftsmen, too, have grown up with the art, and are today out ahead in both skill and quality of workmanship . . . the finished appearance and accuracy of their products reflect their pride of achievement. Mahon design engineers are always available to advise and assist you.

Address STEEL-WELD DIVISION



Here is an Unusual and Intricate Job of Steel-Weld Fabrication Turned out by Mahon Craftsmen.

THE R. C. MAHON COMPANY

Home Office and Plant, Detroit 11, Michigan
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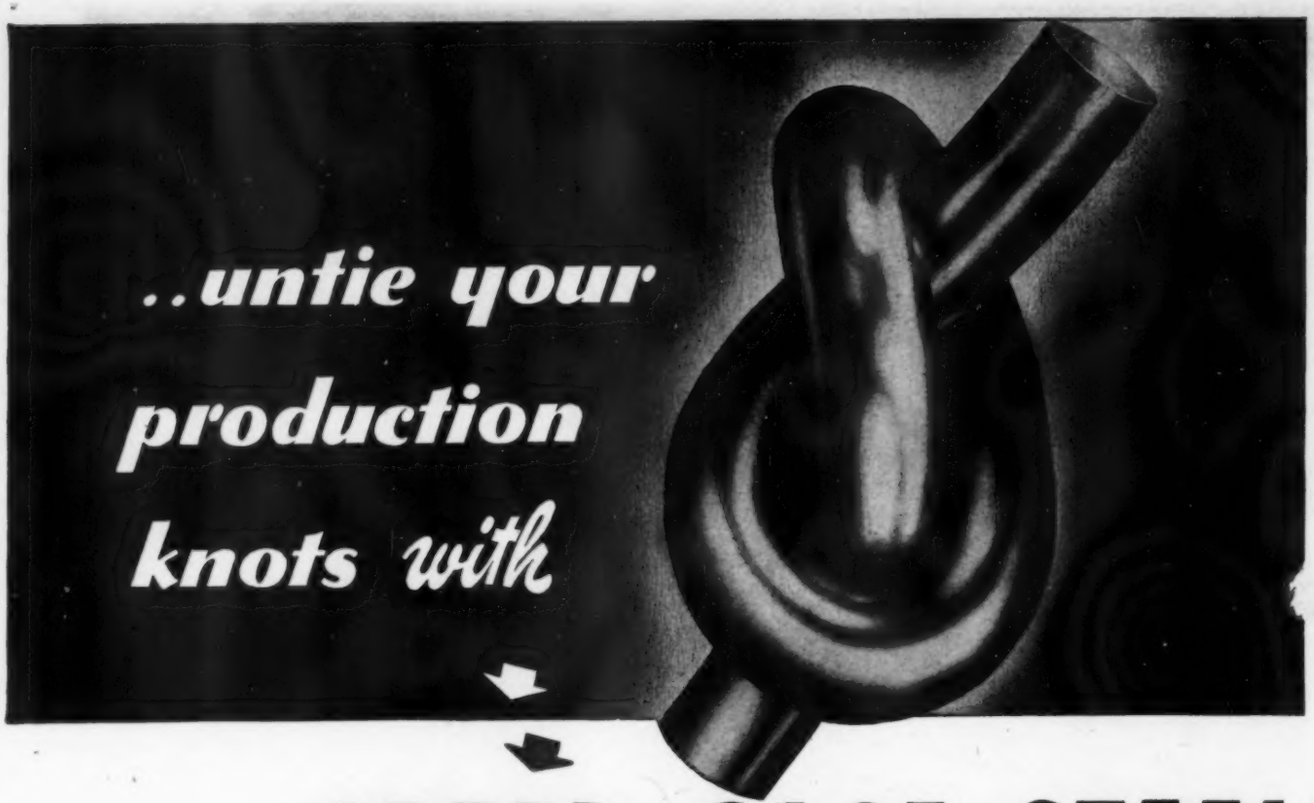
Engineers and Fabricators of Welded Steel Machine Bases and Frames, and Many Other Welded Steel Products

MAHON



SPEED CASE STEEL

X1515 LOW CARBON OPEN HEARTH PRODUCT

PLAN NOW... *and do THIS!*

Write us for samples. When you receive them we will send our Production Expert to you, at our expense. He will show you, in your own plant, how SPEED CASE will increase your production 30 to 100% . . . and lengthen tool life 4 to 5 times.

SPEED CASE STEEL WILL...

machine perfectly at 250 S.F.P.M. It will replace B1112, B1113, C1117, C1118, C1019, etc. It is so ductile it can be tied in a knot, cold, without fracture yet has a tensile of 80,000 to 90,000 PSI. It case hardens to 60-64 RC. Send for samples. Be ready for SPEED CASE when SPEED CASE is ready for you.

Tear off here ATTACH TO YOUR LETTERHEAD AND MAIL TO EITHER COMPANY BELOW

Licensee

MONARCH STEEL COMPANY

HAMMOND · INDIANAPOLIS · CHICAGO

PECKOVER'S LTD., Toronto, Canadian Distributor

MANUFACTURERS OF A COMPLETE LINE OF COLD FINISHED CARBON AND ALLOY STEEL BARS

Licensee for Eastern States

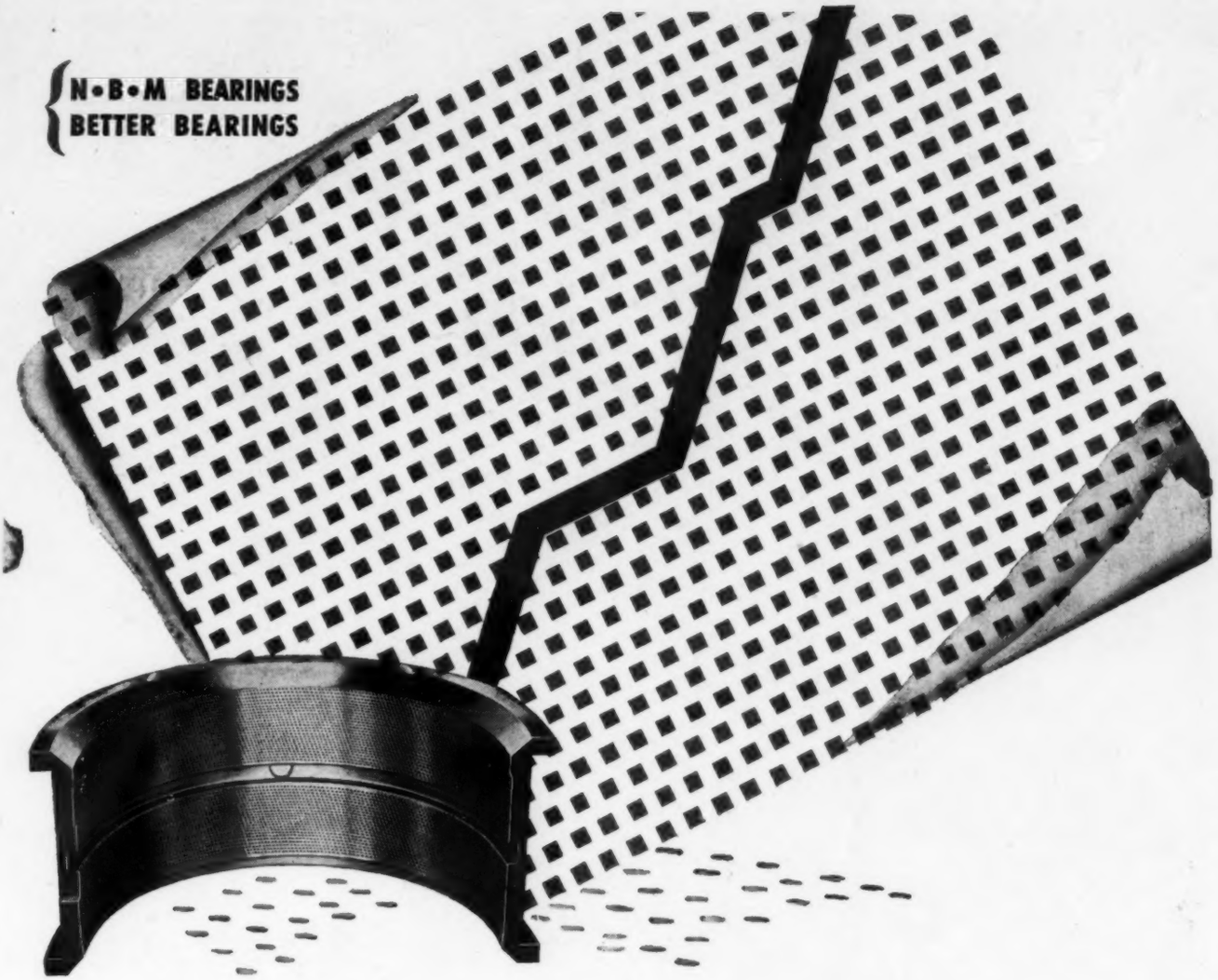
THE FITZSIMONS COMPANY

YOUNGSTOWN, OHIO

ACTUAL PHOTOGRAPH

Speed Case Steel (.20 carbon) 1 inch cold drawn bar tied in a knot, cold, without fracture.

N•B•M BEARINGS
BETTER BEARINGS



N·B·M GRIDDED BEARINGS IMPROVE HIGH-SPEED, HEAVY-LOAD MACHINERY

Diesel engines and other high-speed, heavy-duty machinery can now be equipped with longer-lasting, smoother-running Gridded Bearings.

Special tools, developed by Brake Shoe Research, now produce uniformly-spaced-and-babbitted grids with automatic precision at "mass-production" savings. Now you can use Centrifugally Cast N-B-M Gridded Bearings freely wherever high speeds and heavy loads call for added fatigue strength and safety factor.

Write today for complete engineering data.

NBM

Brake Shoe NATIONAL BEARING DIVISION
ST. LOUIS • NEW YORK

PLANTS IN: ST. LOUIS, MO. • PITTSBURGH, PA. • MEADVILLE, PA. • JERSEY CITY, N. J. • PORTSMOUTH, VA. • ST. PAUL, MINN. • CHICAGO, ILL.

If You make Stainless Steel Parts... you'll like Republic *Enduro* Bars

You'll like Republic ENDURO Bars—hot rolled or cold drawn—because of their *uniform* free-machining qualities. While stainless steels admittedly are tougher than ordinary carbon steels, constant improvement in the free-machining grades has increased their machinability to the point where one grade—ENDURO AA-FM (Type 430-F)—now is rated at approximately 90% that of Bessemer screw stock.

You'll like Republic ENDURO Cold Drawn Bars because of their smooth surface finish and uniform accuracy—their corrosion-resistance and long-lasting qualities. They are processed in a plant handling nothing but stainless and under the same management responsible for the high standards of quality always associated throughout the trade with Union Cold Drawn Steels.

No matter how you use stainless steel bars, Republic's staff of metallurgists and machining engineers are at your service to help you get best results.

REPUBLIC STEEL CORPORATION

Alloy Steel Division • Massillon, Ohio

GENERAL OFFICES • CLEVELAND 1, OHIO

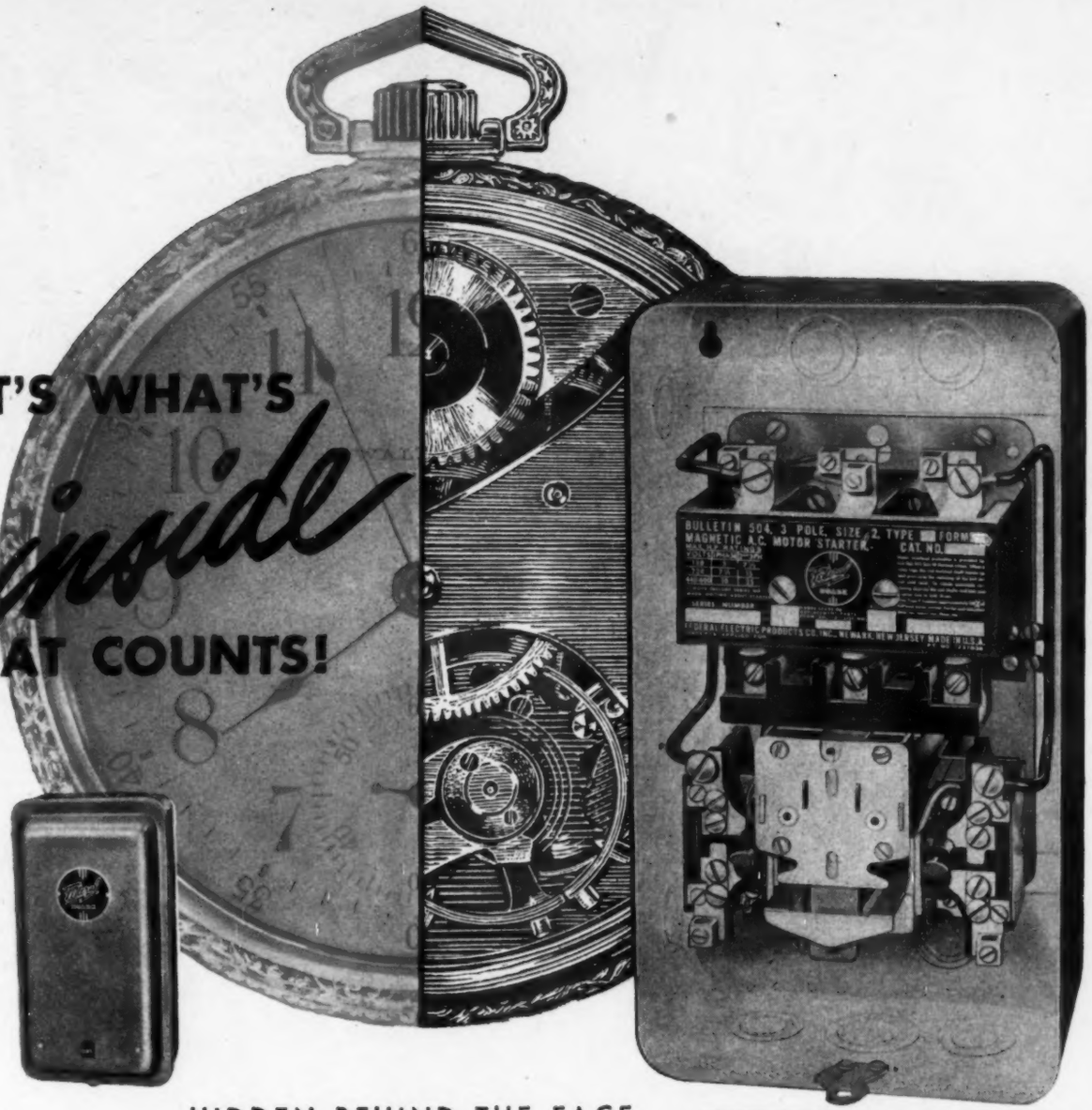
Export Department: Chrysler Bldg., New York 17, N. Y.

Republic REPUBLIC STEEL

ENDURO STAINLESS STEEL

Reg. U. S. Pat. Off.

Other Republic Products include Carbon and Alloy Steels—Pipe, Sheets, Strip, Plates, Bars, Wire, Pig Iron, Bolts and Nuts, Tubing



IT'S WHAT'S *inside* THAT COUNTS!

HIDDEN BEHIND THE FACE of your watch are over 150 precision parts—the "works" that make a watch a useful and dependable mechanism. In FEDERAL NOARK electric products, as in the construction of a fine time-piece, *precision* is a built-in characteristic . . . precision that makes for dependable performance under the most gruelling of operating conditions.

HERE'S THE "WORKS" OF A FEDERAL NOARK MAGNETIC MOTOR STARTER

• Double Break Silver Contacts • Accessible Stationary Contacts • Single Screw Movable Contacts • Heavy Arc Barriers for Strength • Ball Bearings & Movable Yoke • Non-Carbonizing Asbestos Base • Vertical Ball Bearing Action • Quick-Change Coils • Overload Relays — Hand & Automatic Reset • Front Mounted Accessible Heaters

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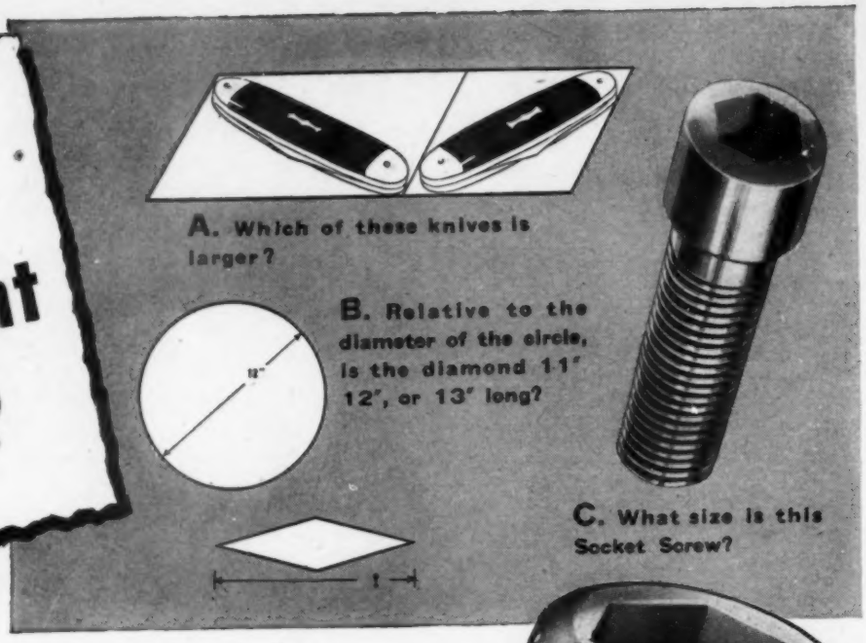
INDUSTRIAL CONTROLS

FEDERAL ELECTRIC PRODUCTS COMPANY, MANUFACTURERS OF A COMPLETE LINE OF ELECTRICAL PRODUCTS INCLUDING: MOTOR CONTROLS, SAFETY SWITCHES, CIRCUIT BREAKERS, SERVICE EQUIPMENT, PANELBOARDS

Can YOU Guess Right on Size?


A. Which of these knives is larger?
B. Relative to the diameter of the circle, is the diamond 11" 12", or 13" long?
C. What size is this Socket Screw?

GUESSING is fun in a game . . . but there's no place for it in shop practice. Wrong guesses cost money . . . and they happen more often than you think. For example, the size and thread pitch of the socket screw above was guessed wrong by many veteran shop men questioned in a recent test. On the job . . . such mistakes waste time.

There's no need to guess...

WHEN IT'S SIZE-MARKED

Just a quick glance at the head of any P-K Cap Screw reveals its size. Clearly incised, easily read, the Size-Mark represents a big forward step in the simplification of assembly operations.

Experienced men like the Size-Mark because it saves their time. Green hands are all for it because it protects them from errors. Tool crib bosses want it because it speeds up the sorting of left-over, mixed-up screws. And the men who service your products will appreciate the Size-Mark because it saves their time on reassembly jobs.

Are you missing this opportunity to aid your assembly workers – to speed up assemblies – and to provide an extra sales feature for your product?

Plus* – GEAR GRIP

Gear Grip on Size-Marked Socket Head Cap Screws is a further aid to fast work . . . makes them slip-proof even when fingers are oily. Write today for samples . . . Parker-Kalon Corp., 200 Varick St., New York 14, N. Y.

ANSWERS:

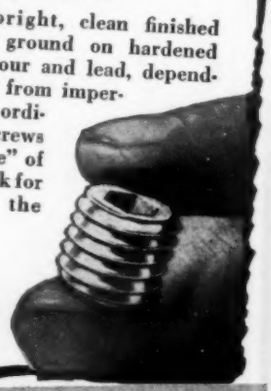
A. Both are the same. B. The diamond is 13" long.
C. There's no question when it's P-K Size-Marked!

* U. S. Pat. No. 126,409

ANOTHER **P-K** FIRST

GROUND THREAD
Socket Set Screws

● Smooth, mirror-bright, clean finished threads – centerless ground on hardened blanks. Accurate contour and lead, dependable Class 3 Fit. Free from imperfections common to ordinary cut thread set screws . . . a "shining example" of good workmanship. Ask for samples. You'll see the difference.



P-K SOCKET SCREWS ARE AVAILABLE FOR PROMPT DELIVERY!

Send for Stock List Now

SOLD ONLY THROUGH ACCREDITED DISTRIBUTORS

PARKER-KALON *Cold-forged* SOCKET SCREWS

4

HOW THESE PATENTED

Felt Seal Ball Bearings

Help Reduce Production Costs of

- ✔ **electric motors, generators**
- ✔ **portable tools**
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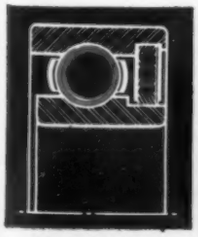
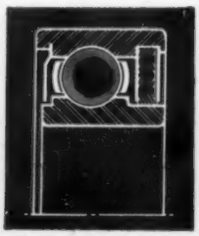
- ✔ **small high-speed devices**

These unique Norma-Hoffmann bearings are equipped with removable, replaceable seals. The thick felt seal, compressed between demountable, hardened spring washers, is entirely within confines of both rings and therefore is not exposed to injury. With the recessed inner ring, it forms a labyrinth that excludes foreign matter and retains the grease. Special seal construction eliminates race distortion; assures dimensional exactness and quiet running. Because of these features the Felt Sealed Bearings can help save production costs 6 ways:

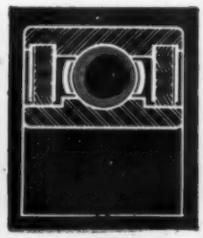
1. The built-in felt seal eliminates need for external sealing parts; saves machining, drilling, tapping.
2. More compact, simplified mountings result.
3. Assembly is speeded up.
4. Prepacked with Norma "Stability-Tested" grease, insures against "dry" bearings.
5. Seal retains grease; excludes dirt.
6. Full width outer ring obviates need for steel inserts in soft metal housings.



Single Felt Seal Ball Bearing



Single Felt Seal Ball Bearing with Shield



Double Felt Seal Ball Bearing

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NORMA-HOFFMANN BEARINGS CORPORATION
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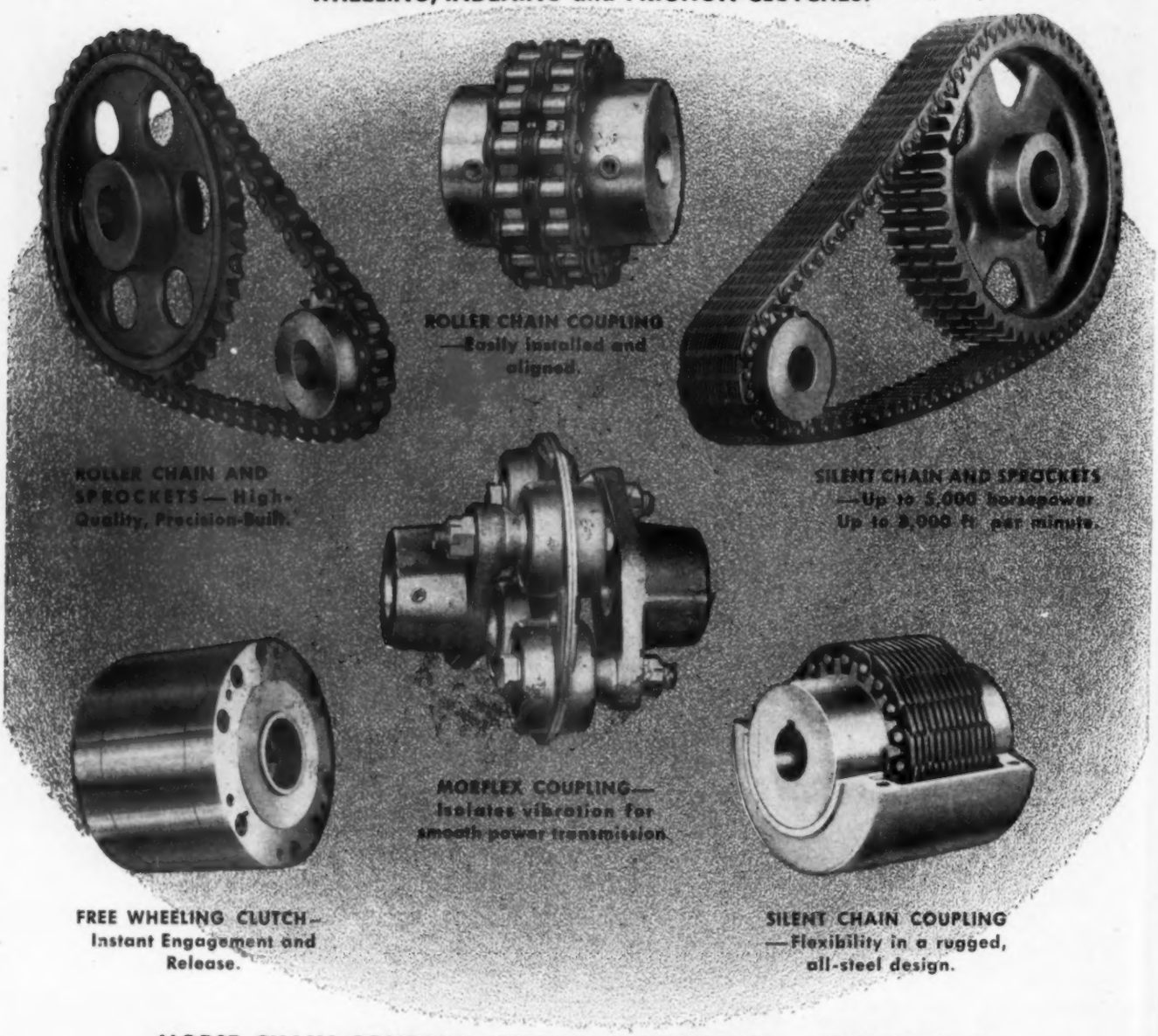
Throughout industry, machinery and equipment manufacturers use MORSE ROLLER and SILENT CHAIN DRIVES, FLEXIBLE COUPLINGS, FREE WHEELING, INDEXING and FRICTION CLUTCHES.



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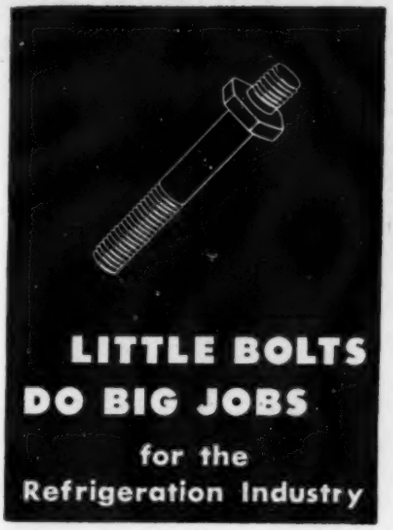
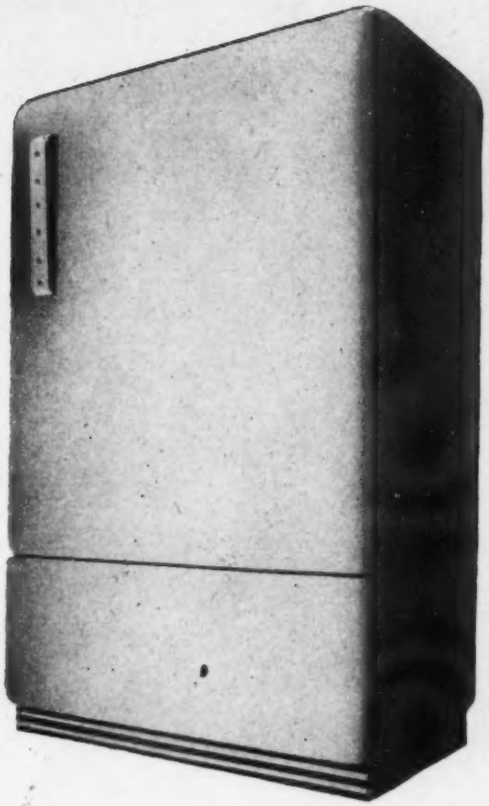
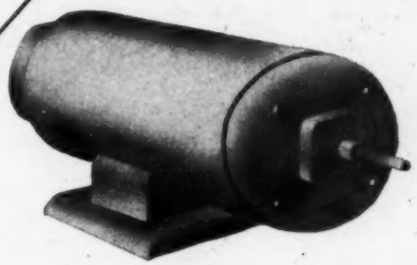


LITTLE BOLTS DO BIG JOBS

for the Refrigeration Industry





THE complexity of modern, manufactured items reflects itself in the increasing demands for special type nuts and bolts. The unusual bolt illustrated, for example, is a *vital* part of the compressor unit of a well-known national brand refrigerator . . . *convincing evidence that little bolts do big jobs for big industry.*

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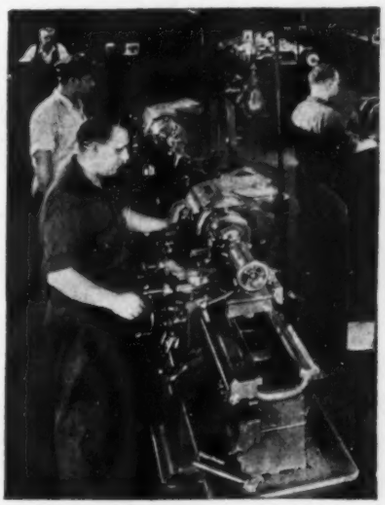

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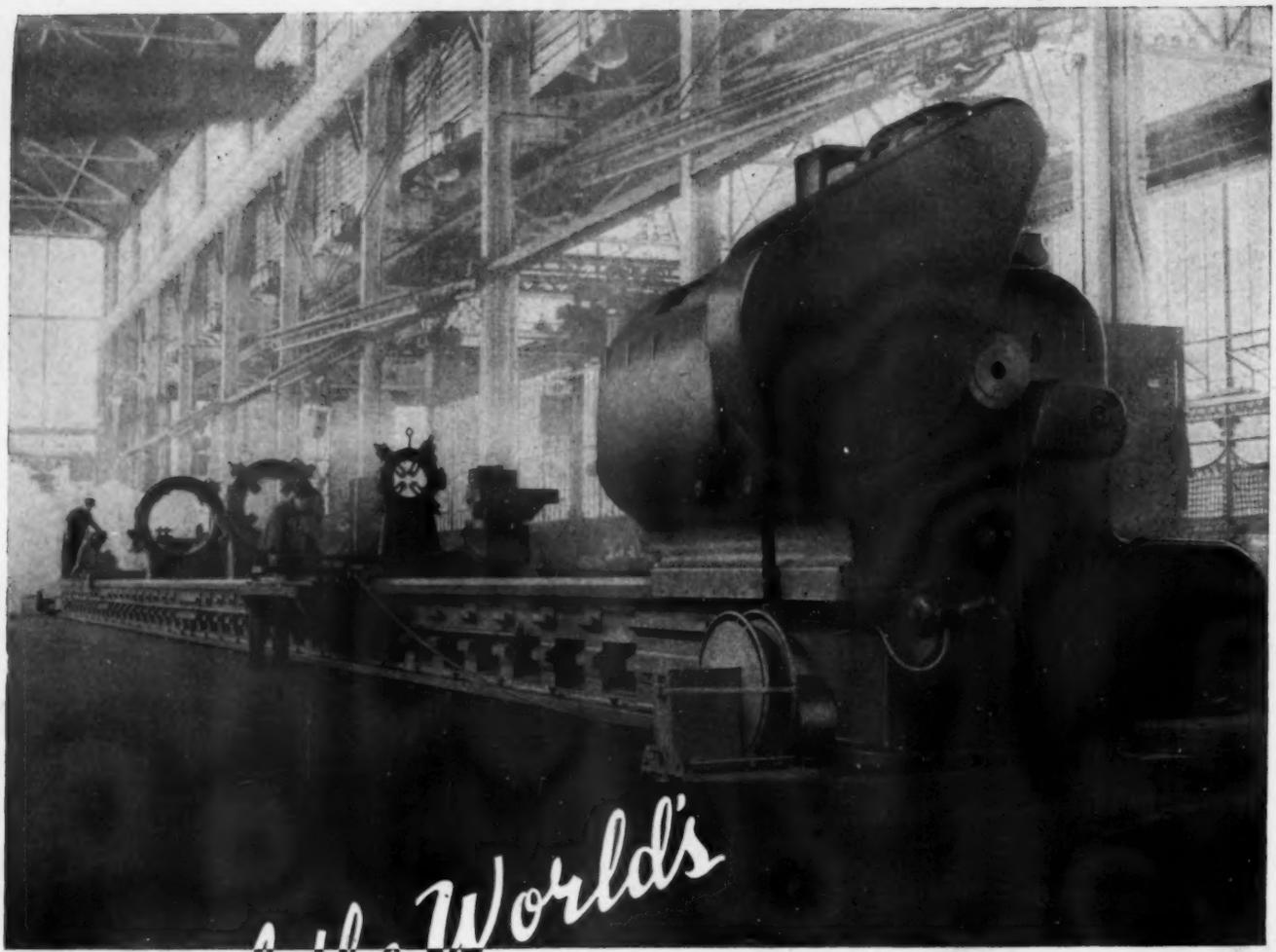

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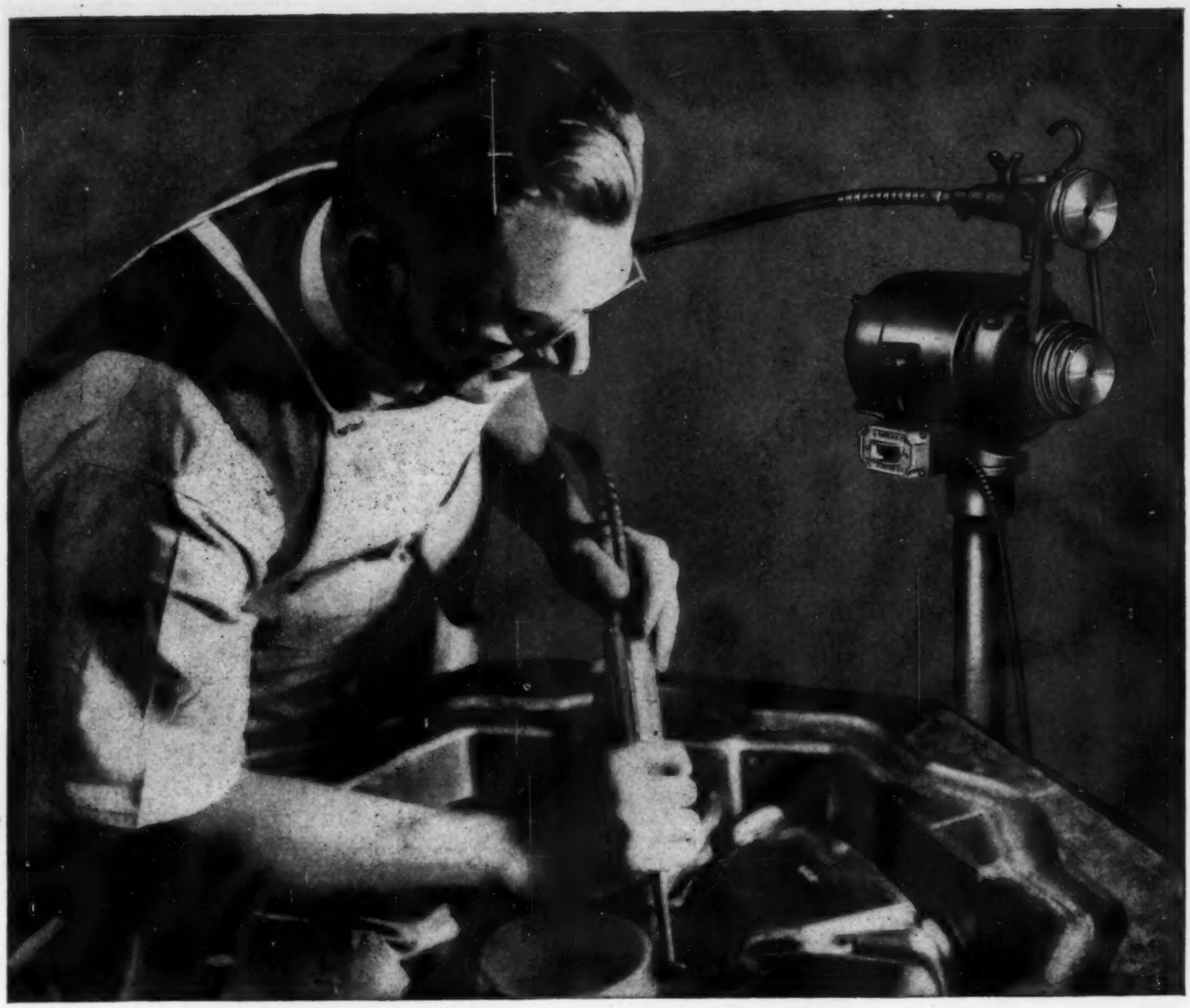

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cuts new exhaust fan bearing unit

- **25% in weight**
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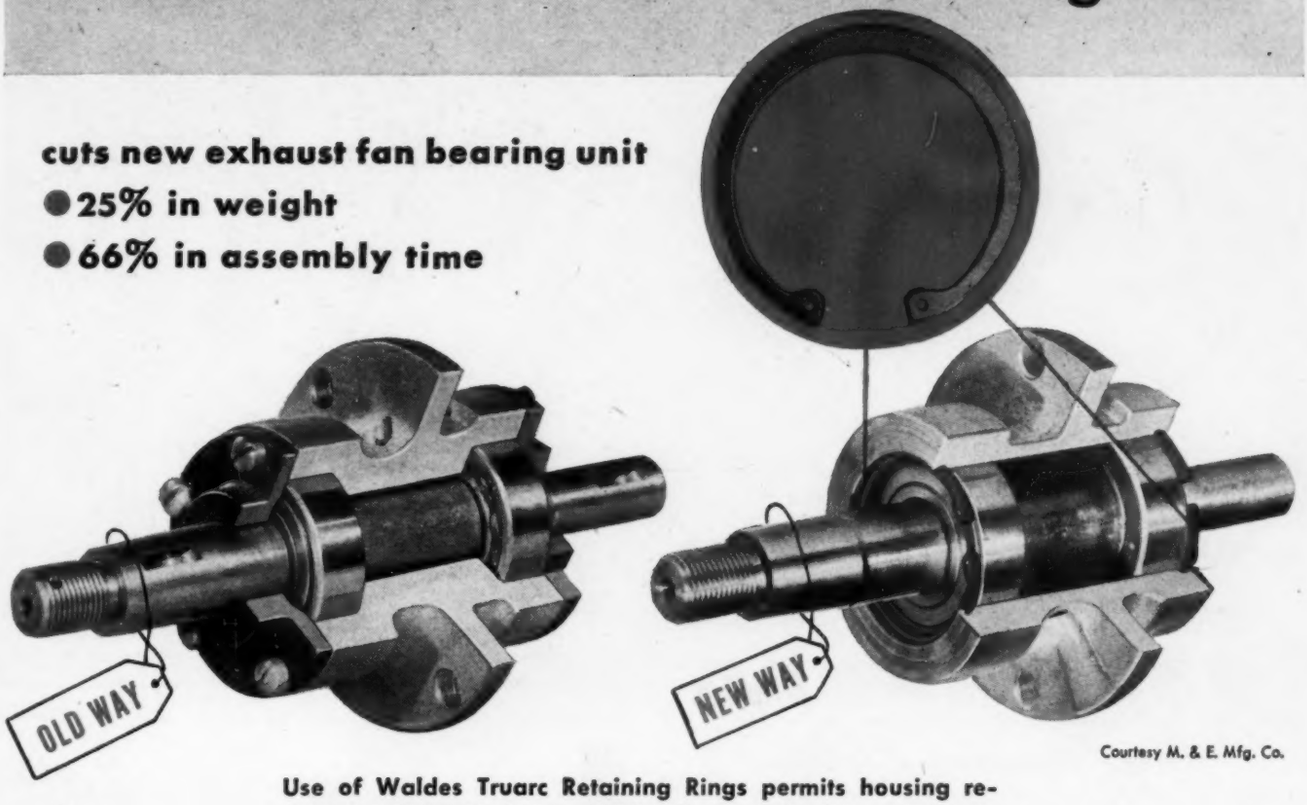

Courtesy M. & E. Mfg. Co.

Use of Waldes Truarc Retaining Rings permits housing redesign—eliminates heavy cast bearing caps and screws requiring drilling and tapping; lowers labor and material cost.

"TRUARC PAYS DIVIDENDS IN SAVINGS!" declares M. & E. Manufacturing Company, of Indianapolis, makers of exhaust fans for industry. "Improvements in design made possible by Waldes Truarc Retaining Rings provide a quieter, freer-running assembly, assure longer life to the entire unit, eliminate the hazards of uneven unnecessary pressure on the bearing and minimize future service requirements. In our experience Truarc has definitely proved itself the better method for doing an important job."

Truarc does a better job on axles and shafts for retaining and positioning wheels, pulleys, cams and gears. In widely varied applications, designers find its never-failing grip, its patented design that assures constant circularity, make Truarc the better way to hold machine parts together. Production and maintenance men in many industries see how Truarc rings cut costs sharply, maintain accurate, unvarying relationship of parts. Send us your drawings; Waldes Truarc engineers will be glad to show how Truarc can help you.

WALDES

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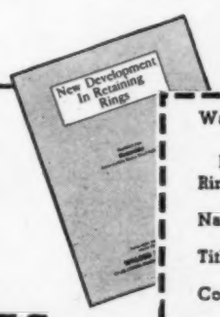
RETAINING RINGS

WALDES KOHINOOR, INC., LONG ISLAND CITY 1, NEW YORK



● ***Send for new Truarc booklet, "New Development In Retaining Rings"***

Waldes Kohinoor, Inc., 47-10 Austel Place 12-K
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Please send booklet, "New Development In Retaining Rings" to:

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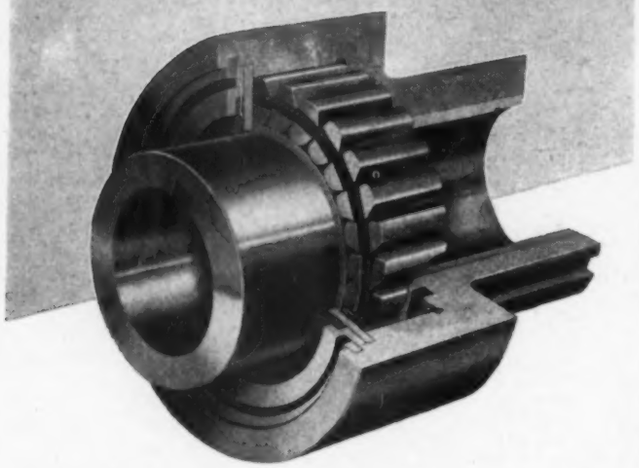

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If you have, or may have, an application, let us give you full information about

FORMSPRAG

THE FULL COMPLEMENT
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You realize, as do we, that there are many applications where ordinary clutches serve the purpose.

But there are hundreds of applications where you need something better! You may need extremely high torque capacity in limited space. You may need a clutch that cuts in and out hundreds of times a minute. You may require such extreme accuracy in your production that only Formsprag will do the job properly.

If you have a tough application — one that requires that "extra something" — it is well worth while to investigate Formsprag.

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ANGULAR AND AXIAL
Anti-Friction Flexible Coupling

Ballflex, quickly installed between keyed flanges, accommodates parallel misalignment up to 1/8" and/or angularity up to 3°. It is packed with lubricant for the life of the unit. Flexibility is by mechanical means only. All torque is delivered by hardened steel balls. Free rolling movement in any direction eliminates side thrust and insures long life for both coupler and bearings

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Still Trying to Make Experimental Models in Your Production Shop?

You don't have to interrupt your production! The next time you need a new tool, gage, machine part, or experimental model, call in Thews, a specialist in designing, experimental and laboratory work. Precision metal working, backed by 32 years' experience, guarantees you a perfect model plus complete working drawings.

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If you handle SCRAP METAL

-you need a DEMPSTER BALESTER

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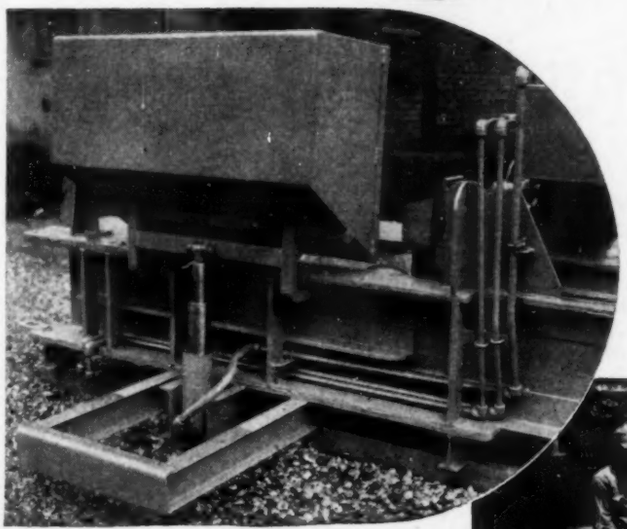
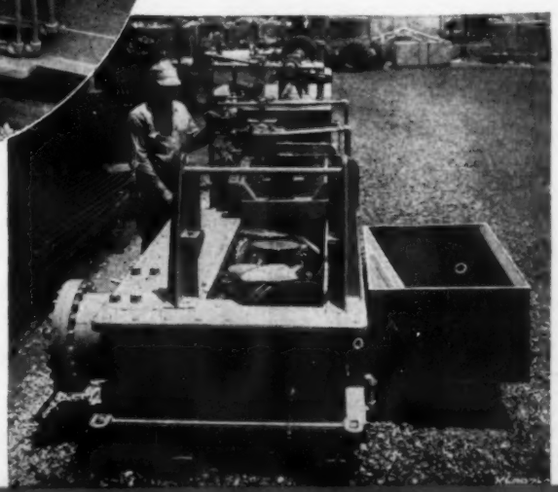


This compact Dempster-Balester, Model 125 portable press, handles any type of scrap metal, no pits or foundations necessary—just place it where needed and it's ready to deliver dependable service for you. Designed for rugged every day service, with all points of strain built oversize to withstand internal stresses beyond the normal need of baling. Charging box is squared and completely lined with abrasion plates with all high spots and toughness machined off. Powered by Electric Diesel or Gas Motors, the Dempster-Balester, equipped with the efficient Skip Pan Loader, is setting increased production records everywhere. Delivers a high density, 125 pound bale that is easily handled from baler to furnaces.

For heavier work and larger bales, investigate the Dempster-Balester Model 275. A powerful baling machine that delivers approximately 275 pound bales. Write or wire today for complete information.



Shown above, top, the Dempster-Balester, Model 125, complete with Diesel Powered Motor. Above, the Skip Pan Loader fills the charging box, note the compact space saving construction of the loader, and the simplicity of the hydraulic dumping mechanism. Right, front view of the Balester with charging box full and loading pan ready for reloading.

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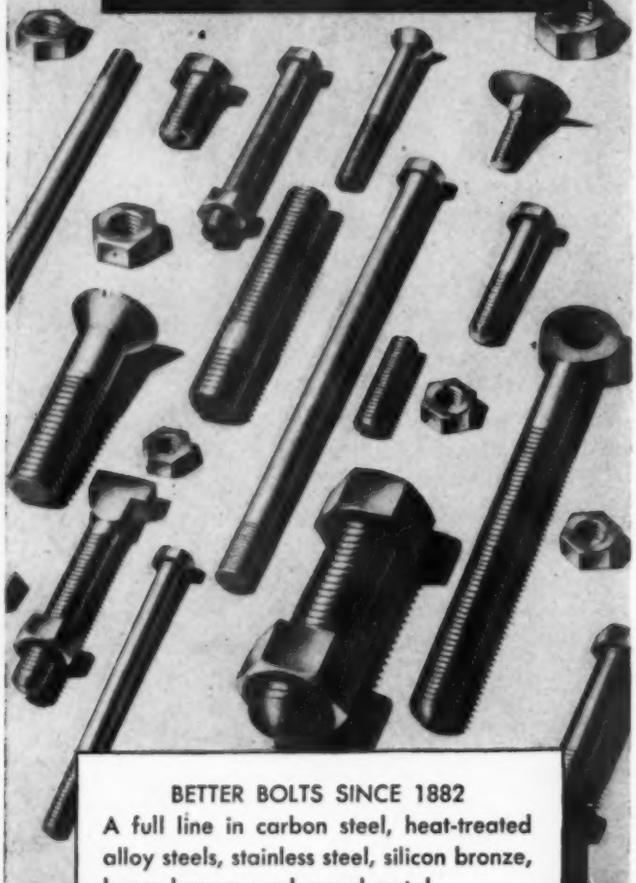
Every standard alloy steel—fabricated into bolts, nuts, studs and many special fastenings. Accurately made in standard dimensions or to meet your specifications.



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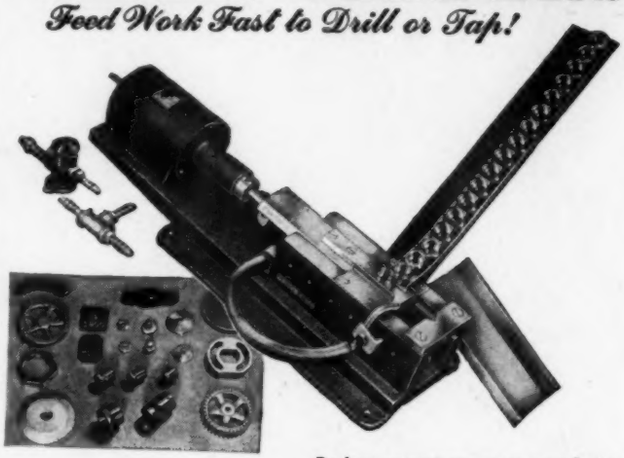
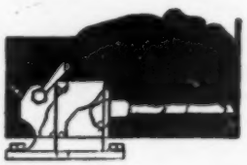
Boost Output with MEAD WORK FEEDERS

Feed Work Fast to Drill or Tap!



As-fast-as-you-can-step-on-a-button the sensational new Mead pneumatic WORKFEEDER delivers, holds, ejects small parts to be drilled, reamed or tapped. Accommodates stampings, castings, screw machine parts, etc. Adjustable to sizes up to 3". Foot automatic control; operator's left hand is free to keep hopper loaded. Write for new Mead AIR POWER Catalog describing "Mead Family" of air operated fixtures and devices.



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A Compact Answer to Your High Pressure Needs

Compact is the word for this internal-gear rotary pump by Tuthill. Model CK is designed to save space, materials and money in high pressure service on machine tools, engines and hydraulic mechanisms. Capacities up to 50 g.p.m. and pressures up to 400 p.s.i. Direct motor drive, V-belt units and integral drives. Write for Model CK bulletin.

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You See at Once That the SIDE of a V-BELT is the part that GETS the WEAR

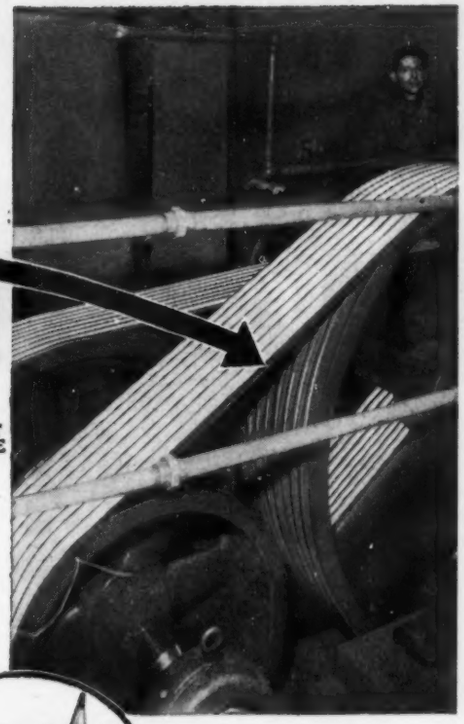


DIAGRAM OF V-BELT IN SHEAVE

Naturally so, because the sides of a V-belt do all the gripping on the pulley. They get all the wear against the sheave groove wall.

It's the sides, too, that pick up all the power delivered by the driver pulley. The sides transmit that power to the belt as a whole. And then, once more, it's the sides--and the sides alone--that grip the driven pulley and deliver the power to it.

That is why you have always noticed that the sidewall of the ordinary V-Belt is the part that wears out first.

---and Now See How the CONCAVE SIDE

(A GATES PATENT)

✓ REDUCES Sidewall WEAR

Greatly Lengthening Belt Life!

Clearly, since the sidewall is the part that wears out first, anything that prolongs the life of the sidewall will lengthen the life of the belt.

The simple diagrams on the right show exactly why the ordinary, straight-sided V-Belt gets excessive wear along the middle of the sides. They show also why the Patented Concave Side greatly reduces sidewall wear in Gates Vulco Ropes. That is the simple reason why your Gates Vulco Ropes are giving you so much longer service than any straight-sided V-Belts can possibly give.

✓MORE Important NOW Than ever Before!

Now that Gates Specialized Research has resulted in V-Belts having much stronger tension members -- tension members of Rayon Cords and Flexible Steel Cables, among others--the sidewall of the belt is often called upon to transmit to the pulley much heavier loads. Naturally, with heavier loading on the sidewall the life-prolonging Concave Side is more important today than ever before!

THE GATES RUBBER COMPANY, DENVER, U. S. A.
World's Largest Makers of V-Belts

Straight Sided V-Belt

FIG. 1

How Straight Sided V-Belt Bulges When Bending Around Its Pulley

FIG. 1-A

You can actually feel the bulging of a straight-sided V-Belt by holding the sides between your finger and thumb and then bending the belt. Naturally, this bulging produces excessive wear along the middle of the sidewall as indicated by arrows.

Gates V-Belt with Patented Concave Sidewall

FIG. 2

Showing How Concave Side of Gates V-Belt Straightens to Make Perfect Fit in Sheave Groove When Belt Is Bending Over Pulley

FIG. 2-A

No Bulging against the sides of the sheave groove means that sidewall wear is evenly distributed over the full width of the sidewall—and that means much longer life for the belt!

472

GATES VULCO ROPE DRIVES

Engineering Offices and Jobber Stocks **IN ALL INDUSTRIAL CENTERS** of the U. S. and 71 Foreign Countries

Gates

6 ADVANTAGES

1 Reduces metal to metal contact

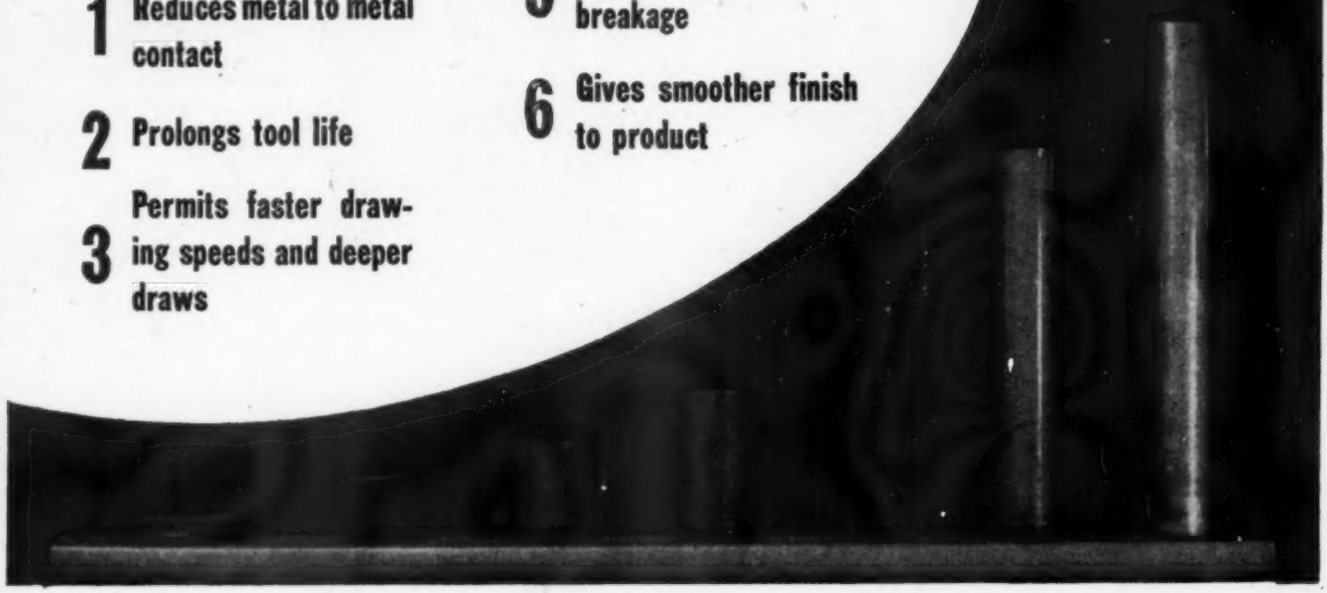
2 Prolongs tool life

3 Permits faster drawing speeds and deeper draws

4 Reduces necessary process anneals

5 Reduces material breakage

6 Gives smoother finish to product



Aluminum cylinders were drawn, with the aid of Bonderizing*, in the steps as shown above. Bonderizing added greatly to the speed, economy and efficiency of the production schedule.

The drawing of steel and aluminum is benefited by Bonderizing in this way: Bonderizing coats the metal with a non-metallic crystalline surface which is integral with the metal itself. These crystals are stretched and crushed in the drawing operation, but remain a cushion between work and tools. Bonderizing has great affinity for oil, holds lubricant through the tremendous pressures of drawing. Faster, more uniform draws result, tearing and scratching is minimized and rejects are reduced, punches and dies last much longer.

Write us for FREE bulletin, "Bonderite As An Aid In Drawing."

PARKER RUST PROOF COMPANY, 2156 East Milwaukee Avenue, Detroit 11, Michigan

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PARKERIZING Inhibits Rust

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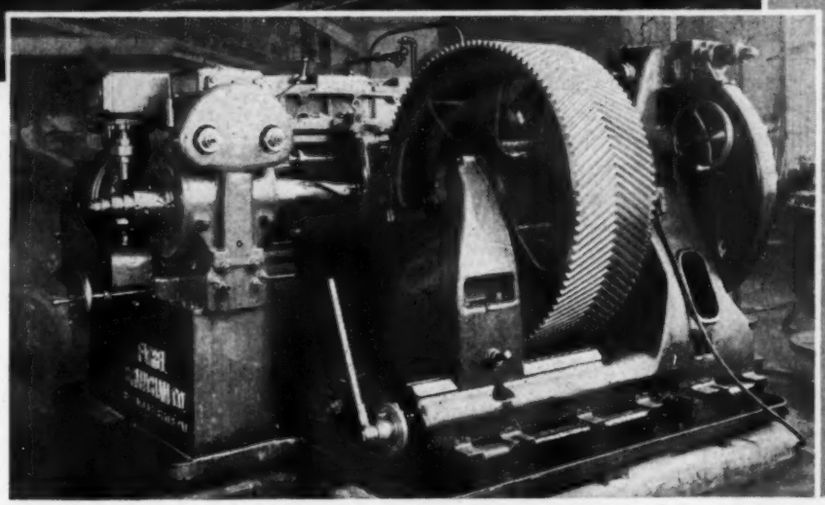
PARKER PRODUCTS CONQUER RUST

BIG GEARS of all TYPES



Big gears of all types, and for all services, have been produced by us for over half a century . . . Helical Gears (see above); Herringbone Gears (shown at right), Bevel Gears, Spurs, Miters, Worms, Spiral-Bevels, Internals, Intermittents, Pinions, Racks, Son-metallics, etc. . . . yes, we have the facilities and equipment for producing one, or thousands of gears, of any type, size or material.

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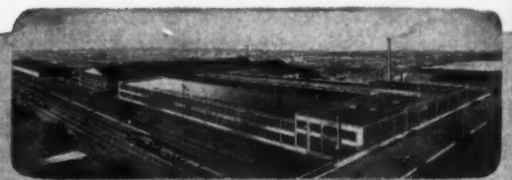
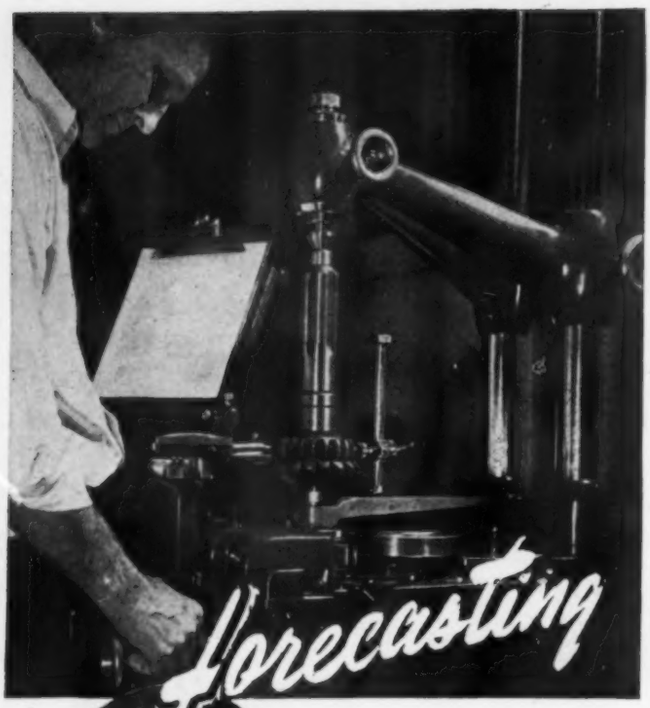
GEAR WORKS INCORPORATED
ERIE AVE. AND G ST., PHILADELPHIA 34, PA.
NEW YORK • PITTSBURGH • CHICAGO . . . IN CANADA: WILLIAM AND J. G. GREEY LIMITED, TORONTO



Industrial Gears and Speed Reducers
LimiTorque Valve Controls



GEAR PERFORMANCE

Fairfield's gear checking department goes out of its way to look for "trouble" and to make sure that it doesn't happen to you. Using the most modern equipment yet devised, experts search for tooth form imperfections that might cause faulty performance. This is only one example of the many safeguards used by Fairfield to insure superior service.

If you use gears, get in touch with Fairfield . . . . over 25 years' experience in manufacturing fine gears plus production facilities second to none are at your service.

fine gears Made to Order!

SPIRAL BEVEL • STRAIGHT BEVEL
HYPOID • HERRINGBONE
HELICAL • DIFFERENTIALS
SPUR • WORMS AND WORM GEARS

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for FINE GEARS

MANUFACTURING CO.
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SHAVED *Gears* . . . for accuracy and efficient performance

- ★ SPUR
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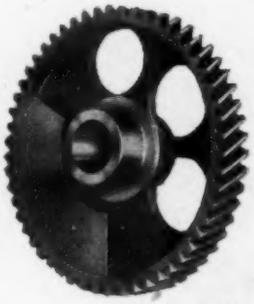
- ★ WORM
- ★ SPECIAL

The Cincinnati Gear Company, in keeping with its policy of making GEARS, GOOD GEARS ONLY, extends to you the facilities of its modern and completely equipped plant.

For example:

To provide the maximum in gear efficiency each CINCINNATI GEAR, where needed, is shaved. We are equipped to handle shaved gears up to 24-inch pitch diameter (maximum). Accuracy is held to within .0002" tooth-to-tooth spacing and .0005" for any two teeth . . . involute is within .0002".



Where performance must be right, specify Cincinnati *Gears, Good Gears Only.*

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"Gears . . . Good Gears Only"
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● For over 43 years we have been meeting the needs of hundreds of concerns for cut-to-order sprockets in all sizes, of any pitch—made from any practical material and in *any quantity.* Our large stock of special cutters places us in an enviable position to quickly meet out-of-the-ordinary requirements as well. Send us your prints for quotation.

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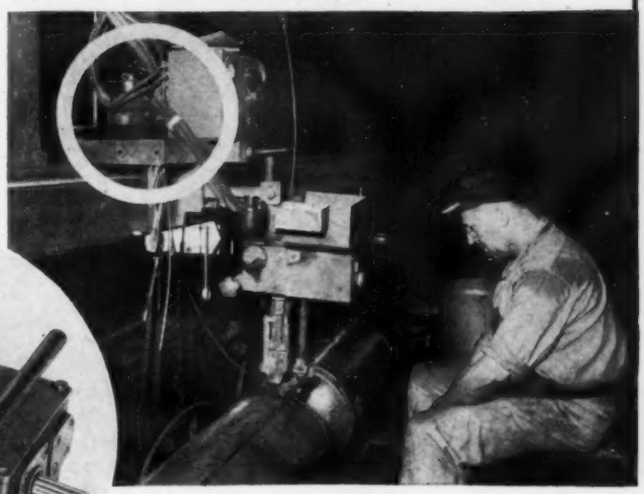
OHIO STOCK SPEED REDUCER

TRANSMITS TRAVEL POWER for

"Lincolnweld"

TRAVEL CARRIAGE and TRACTOR HEAD



Ohio Stock Speed Reducer Number D1 with special attachment case as applied to Lincolnweld automatic travel equipment.

Travel speeds of the Lincolnweld self propelled carriage and tractor heads for automatic welding are dictated by the welding job in hand. Movement must be smooth. Speed must be precision controlled. The entire propulsion unit consists of an electric motor, an attachment case and an Ohio Stock Speed Reducer.

Lincoln Electric Company engineers early recognized the savings possible if a stock reducer could be used in this application. After experimentation the engineers selected an Ohio Stock Gear Reducer.

They found these savings:

1. Heavy tooling expense is avoided.
2. Parts inventory investment is unnecessary.
3. Because it is a stock reducer, cost is lower.
4. Customers are insured quicker replacement, less costly downtime.

. . . and for more than a decade, Lincoln users have continued to profit by these savings which Lincoln has passed on to them.

Ohio Stock Speed Reducers and Gears may offer definite advantages for your product. Check with our engineers today.

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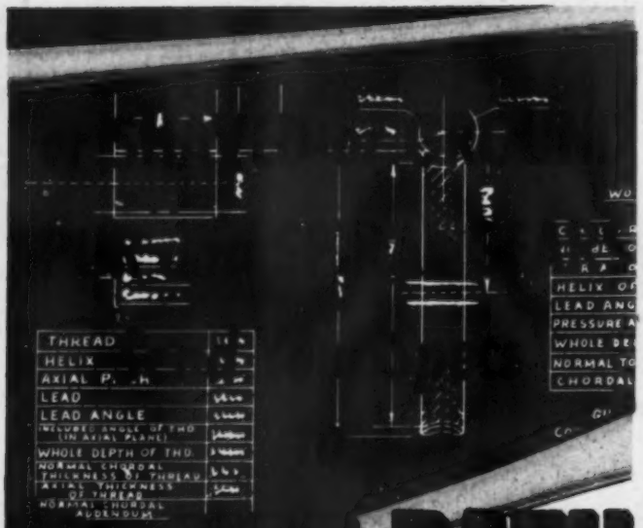
OHIO GEARS



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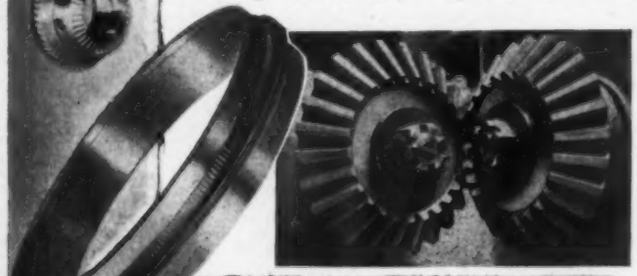
IN LINE with our established policy of furnishing only gears of the highest accuracy, we have recently invested in the latest types of gear shaving and gear grinding equipment. To those manufacturers who appreciate the design and mechanical advantages of precision gears, we offer production facilities that are unusual—to say the least. It will save you time and money to have your gears made right the first time—and every time. Send your specs to Sier-Bath.



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• Spur, helical and worm gears to 48" diameter 3 D.P. and finer; straight tooth bevel gears 32 pitch to 3 pitch, up to 23" P.D. depending on ratio. Gears shaved from 1" to 24". Continuous herringbone gears generated by Sykes method up to 37" O. D. Worms and threads precision ground on J. & L. Thread Grinder to extremely close tolerances. Spur gear grinding up to 16" diameter; helical gear grinding up to 10" diameter. Involute and straight side splines ground up to 42" between centers.

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Sier-Bath
GEAR and PUMP CO., Inc.

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Geared for Economies

Braun knows the metallurgy and methods that reach rock-bottom cost in the volume production of gears. This knowledge comes from 38 years experience. Often customers' designs and specifications can be safely simplified. Learn what Braun can do for you in reducing costs of gears. Send an inquiry.

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and the way MEISEL builds gears, there's just one *right* gear for any specific job. Designed for use under conditions that exist, MEISEL Gears actually "belong" to a machine . . . are inherently able to give longer, quieter, more economical service. Investigate the advantages of *specifically* engineered gears by MEISEL.

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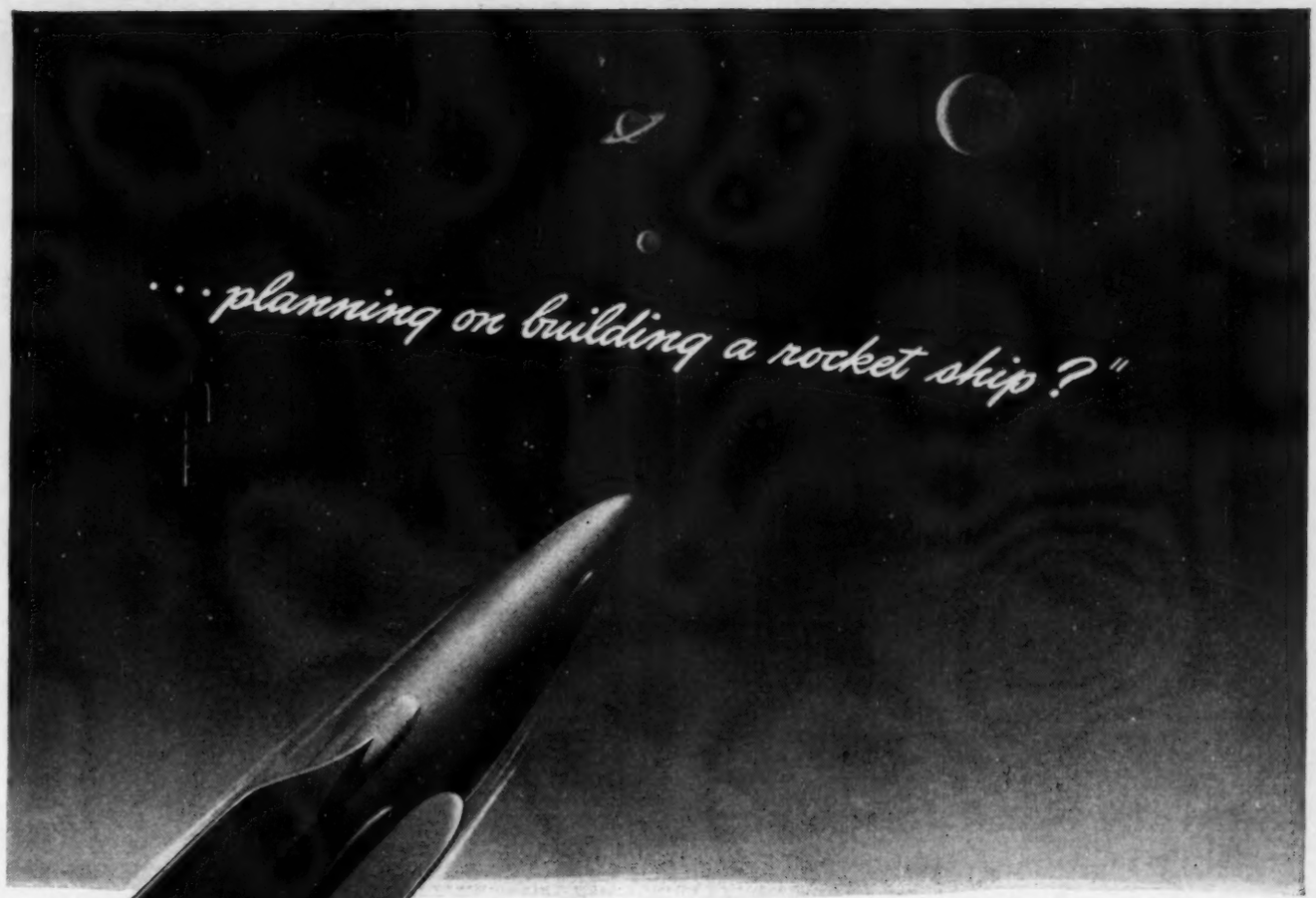

How long will it be before exploration of stellar spaces becomes practical? Ten years—fifty years—a hundred years? It is not wise to predict, particularly when we consider the advances that the past few years have brought.

But if you are developing a rocket ship, you will undoubtedly call on Foote Bros.—just as in the past manufacturers of other marvels of transportation have.

Today, Foote Bros. is producing precision gears of Aircraft Quality for many purposes where light weight, extremely high speeds, maximum efficiency, compactness and low noise level are important. Foote Bros. Power Units and Actuators provide absolute control from a remote point. These units assure accurate mounting so essential if the full benefit of "A-Q" Gears is to be realized.

Regardless of what your requirements in power transmission may be, Foote Bros.' two large plants are ready to serve you. The Precision Gear Division has complete facilities for producing "A-Q" Gears and Power Units in quantities. The Industrial Gear Division is equipped to turn out giant gears up to 20 feet in diameter or production runs of smaller gears. This division also manufactures speed reducers in sizes and ratios to meet almost every industrial need

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...Turbo-Jet Engines

...such modern transports as the Lockheed Constitution

...such revolutionary developments as the Northrup Flying Wing

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DEPARTMENT A, 4545 S. WESTERN BOULEVARD, CHICAGO 9, ILL.

A recent bulletin on Power Units gives complete engineering data on "packages of power." Sent on request. Also available, a bulletin on Aircraft Quality Gears. Mail coupon.

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Please send me Bulletins on: ☐ Power Units ☐ Aircraft Quality Gears.

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These big gear blanks, waiting to be sent to the machines for cutting illustrate the capacity of the Stahl plant. They're waiting, but they won't wait long, because Stahl equipment and Stahl skill in handling this type of work will speed them through the shop and out to you—big gears . . . well cut!

We are Big Gear Specialists, equipped to handle spurs up to 6' in diameter, and other sizes in proportion. For any type of gear—any size, any quantity—get a Stahl estimate first!

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★ SPUR—¼" to 36" O.D.
★ INTERNAL—to 36" O.D.
★ WORMS and WORM GEARS

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GEARS • CAMS
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THE HARTFORD SPECIAL MACHINERY COMPANY
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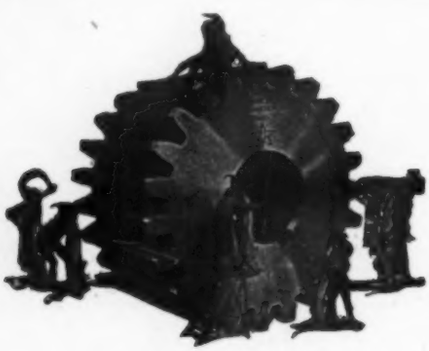

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Better Gear Products

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FIRST AID FOR AILING MOTORS

Look at the BEARINGS

Electric Motors grow *lazy* too! Long hours of steady operation plus frequent overloads lower efficiency . . . increase power consumption. Before you blame the motor take a look at the bearings.

The bearing is one of the most vital parts of a motor. Only when the bearings are correct in design, properly installed, and adequately lubricated, do you get top efficiency. When replacement is necessary specify Johnson E M (Electric Motor) Bearings. From our list of over 250 stock sizes it is easy to secure your needs. Every bearing is correct in design, alloy, and tolerance. Our new catalogue describes this complete service in detail. Why not write for a copy today? Johnson Bronze Company, 515 South Mill Street, New Castle, Pennsylvania.

Manufacturers

of Electric Motors find Johnson Bronze a dependable source of supply for all their Sleeve Type Bearings. We help them make the correct choice . . . we deliver their requirements strictly to specifications. Our advice is available without obligation.

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For REPLACEMENT Specify JOHNSON EM ELECTRIC MOTOR BEARINGS

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QUAKER CITY GEAR WORKS, INC.

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See Issue January 16th, 1947 American Machinist

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New Design
New Features
New Advantages

NEWARK GEAR CUTTING MACHINE CO.
69 Prospect Street, NEWARK 5, NEW JERSEY
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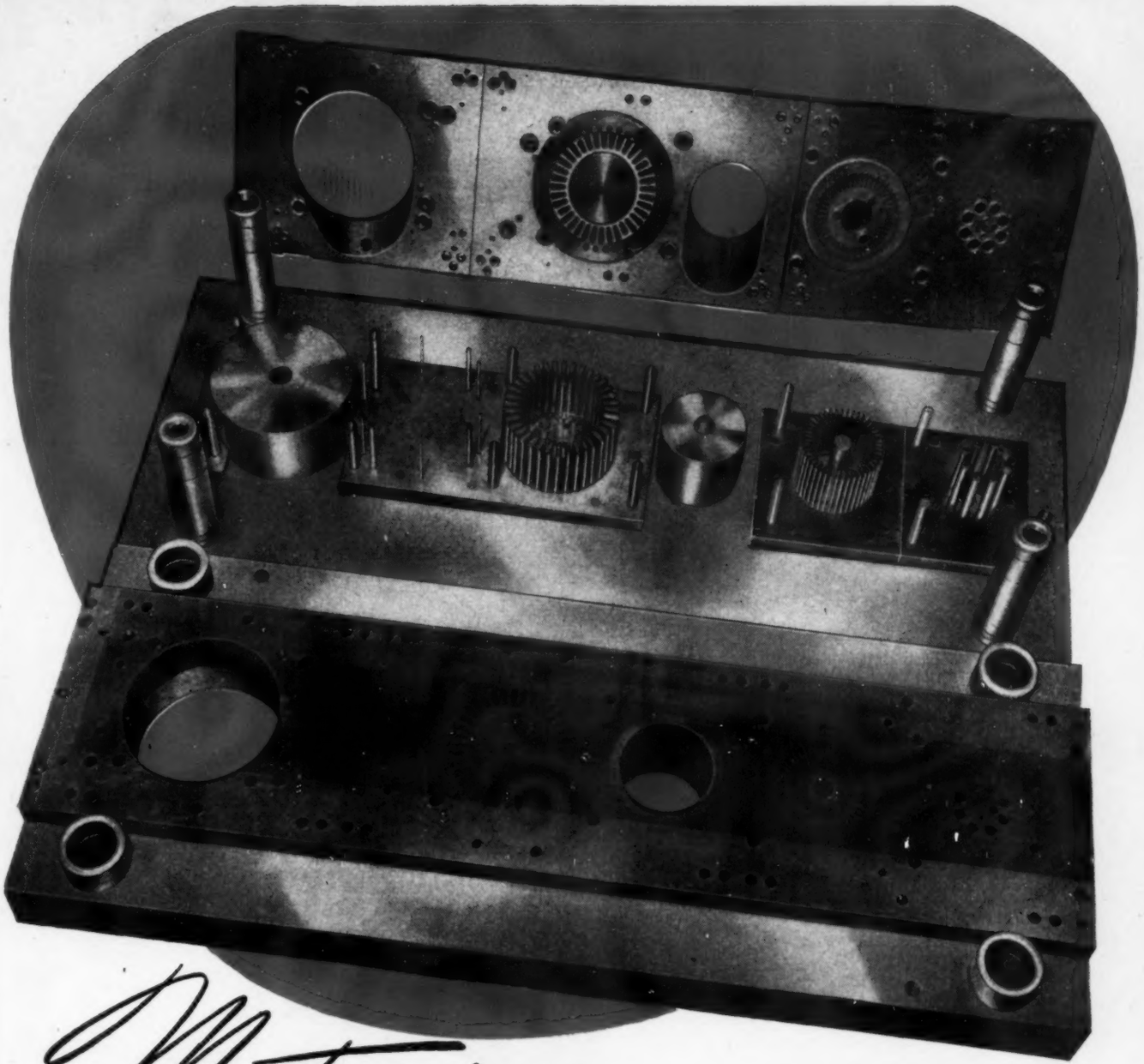

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100,000 pieces per grind . . . 100% increase in production over former dies . . . is the outstanding performance of this Cromovan six station, progressive lamination die. The die punches out both rotor and stator laminations complete . . . from .025 silicon lamination sheets . . . clearance tolerance of .0007 inch per side is strictly maintained between punches and die. All cutting surfaces of this die are made of CROMOVAN.

Call **Firth-Sterling**

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Talide
(TUNGSTEN CARBIDE)
Performance!

On any application involving cutting tools, drawing dies, or wear parts in your plant, you can up your production many times over by using Talide Tungsten Carbide.

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Properly applied, Talide Metal's original cost is no factor as proved by experience of the past 15 years in all types of industrial applications. Let our sales engineers give you full particulars and recommendations.

★TALIDE METAL MEETS EVERY REQUIREMENT★

the hardest metal made!

- Hardest man-made metal.
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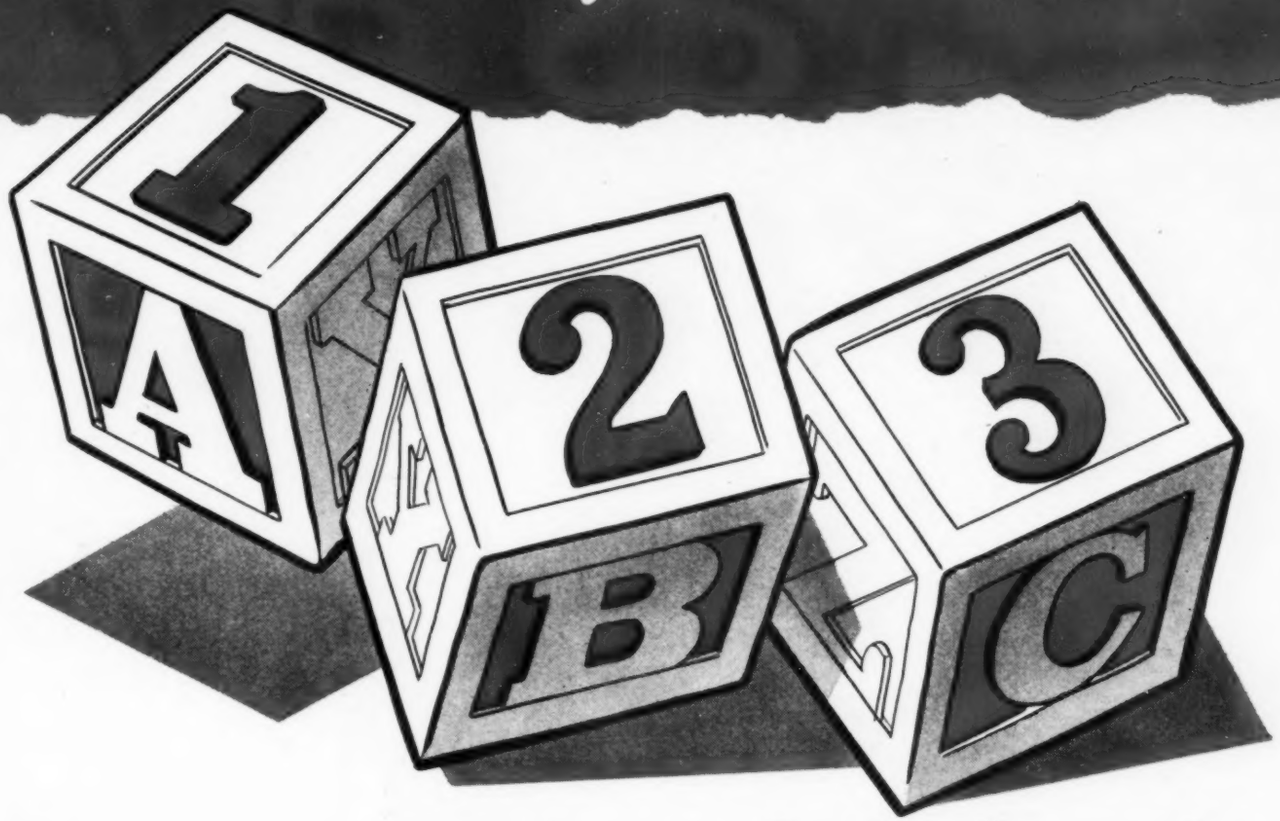
CUTTING TOOLS · DRAWING DIES · WEAR RESISTANT PARTS

It's as easy as...



to use coded lubrication

1 Why you need it. Standard's Coded Lubrication provides one of the simplest known methods for helping oilers determine what lubricant is needed at every lubricating point in your plant. It helps them avoid errors in filling oil cans, grease guns and other dispensing equipment. It eliminates the need for their learning a great number of detailed instructions and grade numbers of lubricants.

2 How it works. All lubricants used in the plant are assigned numbers. A number is applied to each storage container or dispensing unit indicating the lubricant it contains. Each spot to be lubricated is also marked by an easily applied decal numbered to indicate the lubricant required.

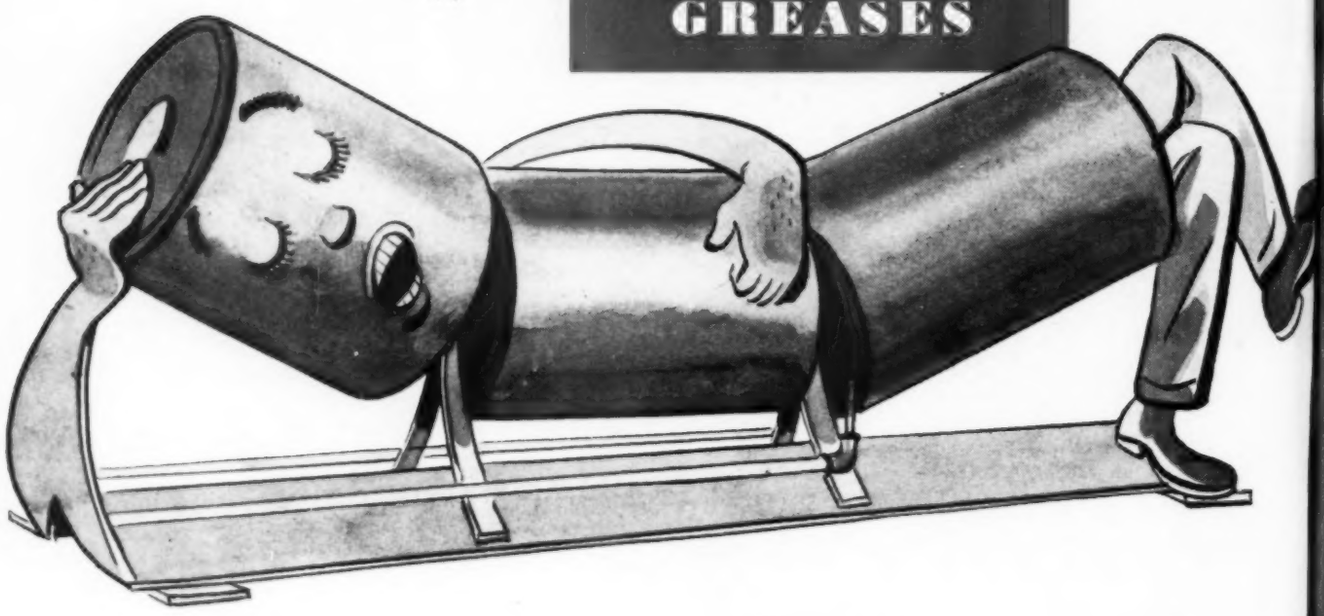
3 What it does! The results you get with Coded Lubrication make it well worth while. It reduces breakdowns resulting from the application of wrong lubricants. It prevents application of costly lubricants where ordinary lubricants can be used. It simplifies training of oilers.

A Standard Oil Lubrication Engineer will fully explain Coded Lubrication and its application to your plant. Write Standard Oil Company (Indiana), 910 S. Michigan Ave., Chicago 80, Ill.

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

Wake up idle idlers with

SUPERLA
GREASES



Save power... belts... and material-handling time on conveyors

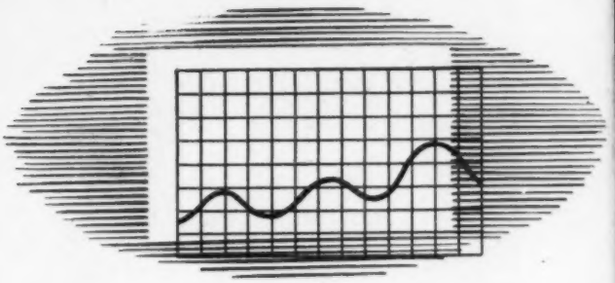
ARE CONVEYOR IDLERS slow to start up in cold weather? Do they heat up, throw off grease, and run dry when the weather's hot?

A change to a better lubricant may make these lazy idlers carry their share of the load—and incidentally save on power, belt wear, and material-handling time.

Superla Greases are ideal for idlers. Grades are available that permit idlers to turn readily at low temperatures, yet these lubricants do not thin out or separate when normal operating temperatures are reached. Where temperatures are above normal (over 175°F.), Superla X Greases resist separation and oxidation, and have good sealing quality.

A Standard Oil Lubrication Engineer will gladly help you make a test. Standard Oil Co., (Ind.), 910 S. Michigan Ave., Chicago 80, Ill.

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE



CLEARING PRECISION Whips this Severe Test

In the illustration at left is remarkable evidence of the precision built into every Clearing press. Although multiple dies are quite common in a single action press, it is unusual to see more than one draw die in a double action press. The Clearing double action, four point suspension press pictured here has three. At every stroke, this press performs simultaneously the first and second draws on a washing machine tub, and the second draw on the spinner.

To accomplish this, the blankholder or outer slide of the press is actually used in drawing the tub. The rigidity required for the accurate three-die draw is ensured by the Clearing one-piece welded frame, and by the long adjustable guide gibs which keep slides and bed constantly parallel.

Here's one more piece of evidence to prove what Clearing engineering competence has done, many times over, to meet unusual press demands. No matter how special your problem may be, Clearing engineers have the imagination and the technical knowledge to make your production dreams come true. As you plan tomorrow's operations, it will pay you to consult with Clearing.

SPECIFICATIONS

Capacity: Inner slide, 900 tons
Outer slide, 800 tons
Stroke: Inner slide, 42"
Outer slide, 31"
Strokes per Minute: 5
Bed Area: 106" x 102"
Die Cushion Equipment: 240 tons

CLEARING

THE WAY TO EFFICIENT MASS PRODUCTION

CLEARING MACHINE CORPORATION
6499 WEST 65TH STREET • CHICAGO 38, ILLINOIS

We know many experienced tool- and die-makers who unreservedly give BTR the green light.

Theirs is a highly-skilled craft where caution pays dividends; where safe-hardening steel is an essential. And BTR is in their shops because it meets this need.

You can quench it confidently, without fear of cracking hazards. Two reasons for this are its balanced analysis of manganese, chrome, tungsten, and vanadium—and its ability to oil-harden at relatively low temperatures.

You'll find, too, that distortion is minor; that BTR machines well and is high in both wear- and shock-resistance. Use it for dies and tools with sharp dimensional changes . . . angular corners . . . thin webs. It has many other uses, too; as a general-utility steel, it's a mighty handy grade to have on your shelves.

In the tool-steel business, "safety first" means BTR. Try it once and you'll see what we mean.

TYPICAL ANALYSIS	C	Mn	Si	Cr	W	V
	0.90	1.20	0.30	0.50	0.50	0.20

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast
Bethlehem products are sold by
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BETHLEHEM STEEL

BETHLEHEM TOOL ROOM . . . one of Bethlehem's *Big 8* Tool Steels

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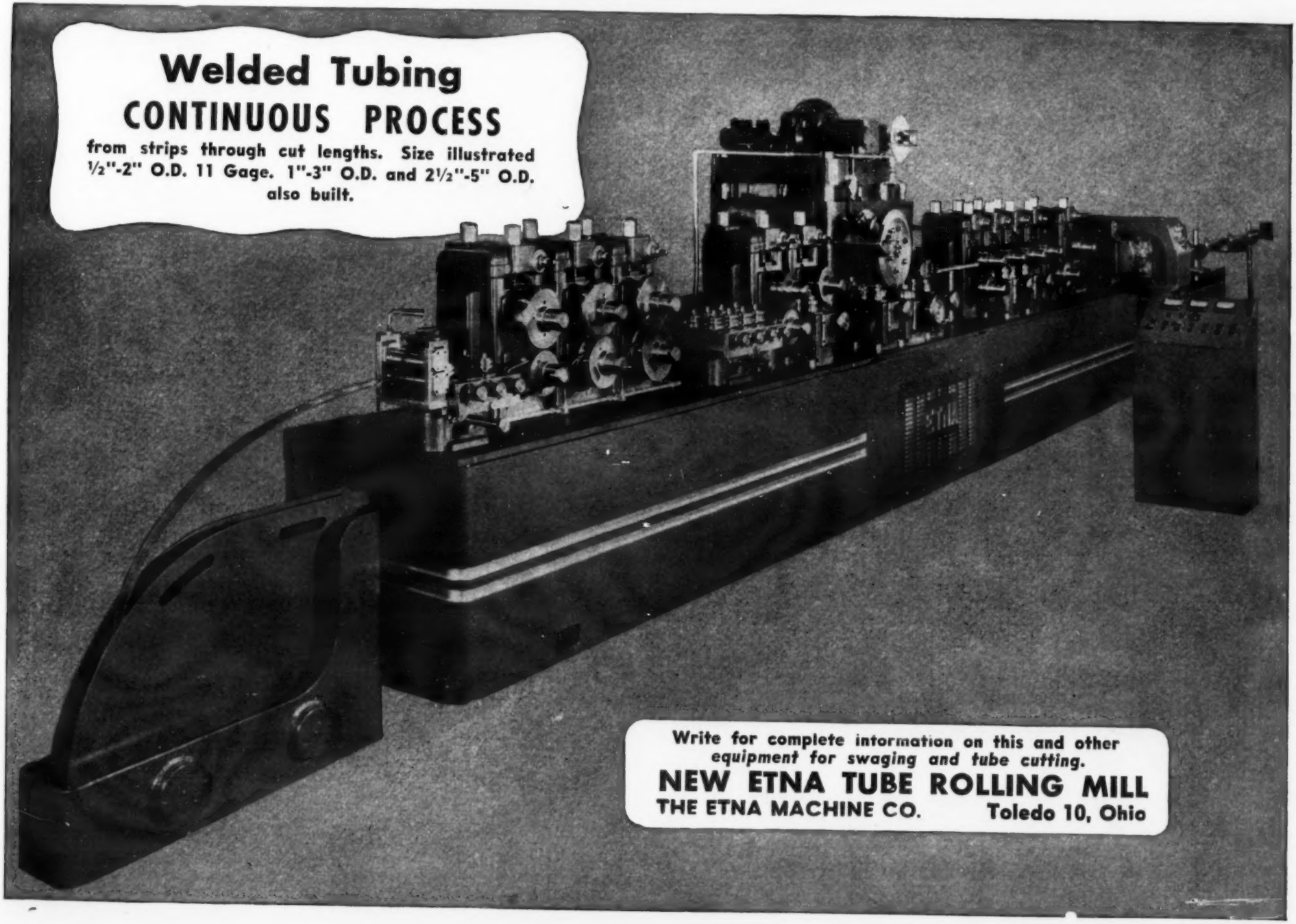
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CONTINUOUS PROCESS
from strips through cut lengths. Size illustrated ½"-2" O.D. 11 Gage. 1"-3" O.D. and 2½"-5" O.D. also built.
Write for complete information on this and other equipment for swaging and tube cutting.
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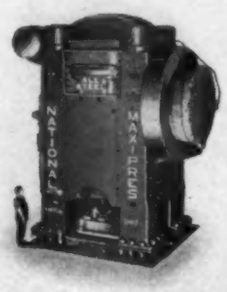
COMPETITIVE

Highly competitive forgings...like this 13½" dia. pipe flange... are produced to best advantage on National High Speed Forging Maxipresses.

Increased output, savings of material, less machining and better physical properties are some of the reasons.

Our analysis of your forging problems is yours for the asking.



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MACHINERY COMPANY
TIFFIN, OHIO.

DESIGNERS AND BUILDERS OF
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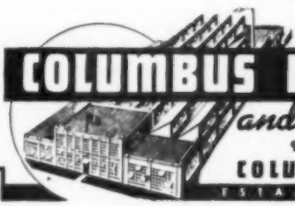

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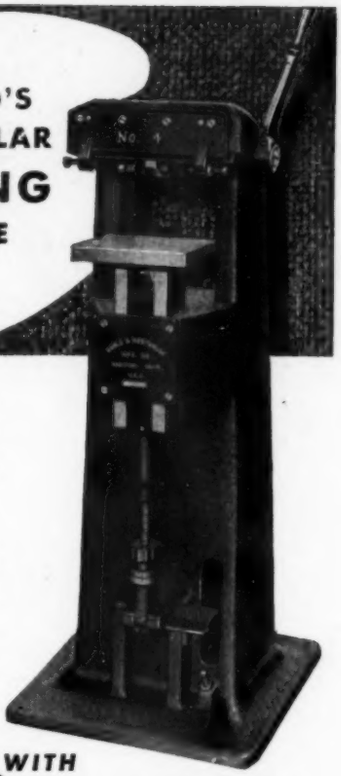

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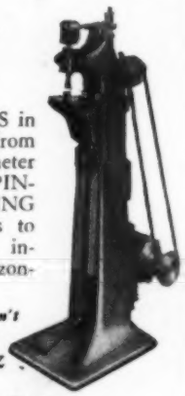

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All Baumbach Die-Sets have demountable Leader Pins and Bushings. This exclusive feature permits removing Leader pins for machine work on the die shoe and assures reassembly without loss of alignment. A big time and trouble saver. Write for Catalog.

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NO DIES!

DI-ACRO PRECISION MACHINES "DIE-LESS DUPLICATING"
Pronounced "DIE-ACK-RO"

"DIE-LESS" DUPLICATING might be described as a new industrial technique made possible by the accuracy, extreme adaptability and ease of operation of DI-ACRO Precision Machines — Shears, Brakes, Benders — especially when used as a continuous, integrated production process.

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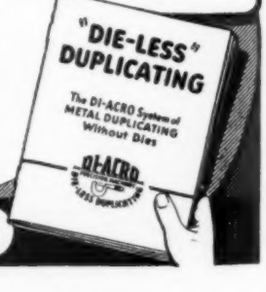

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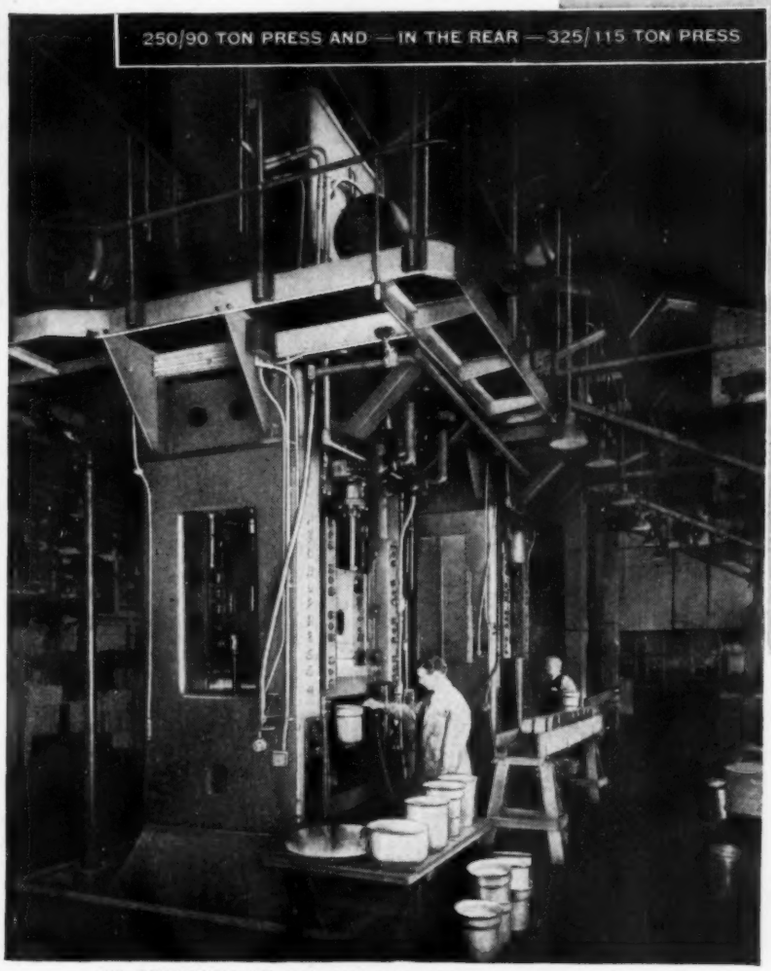

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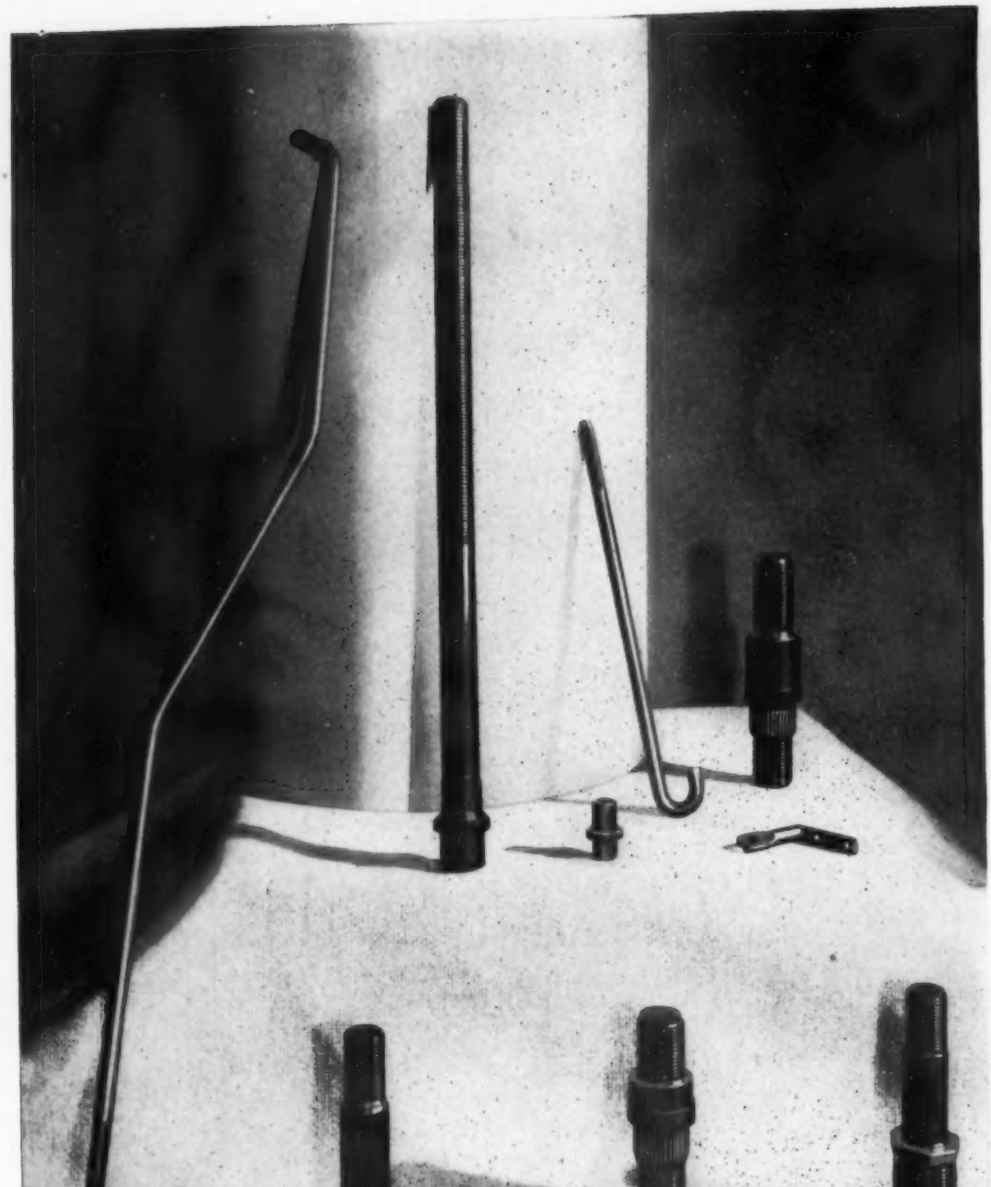

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High volume production at low cost . . . tolerances as close as are required for most machined parts . . . strength and durability . . . "on time" delivery . . . are guaranteed by Allied's experience in producing cold forged parts. Quotations figured from your part prints will be submitted promptly.

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BAKER

... KEY TO Increased Productivity

A recent survey of industry shows that *new methods* and *new machines* are highly important factors today in obtaining *increased productivity.*

This is particularly true among users of Baker Machines—because every Baker is designed to make it easier for the operator to produce *more* in *less* time with *less* effort!

By combining operations and reducing work-handling, Baker Machines offer the right set-up for greater production and improved accuracy. Baker units are highly flexible . . . can be adapted to a wide range of operations including single or multiple spindle drilling, boring, reaming, counterboring, hollow milling and chamfering. Send us details about your job-problem. We'll be glad to show you how a Baker Machine will help you beat rising costs with an upswing in productivity!

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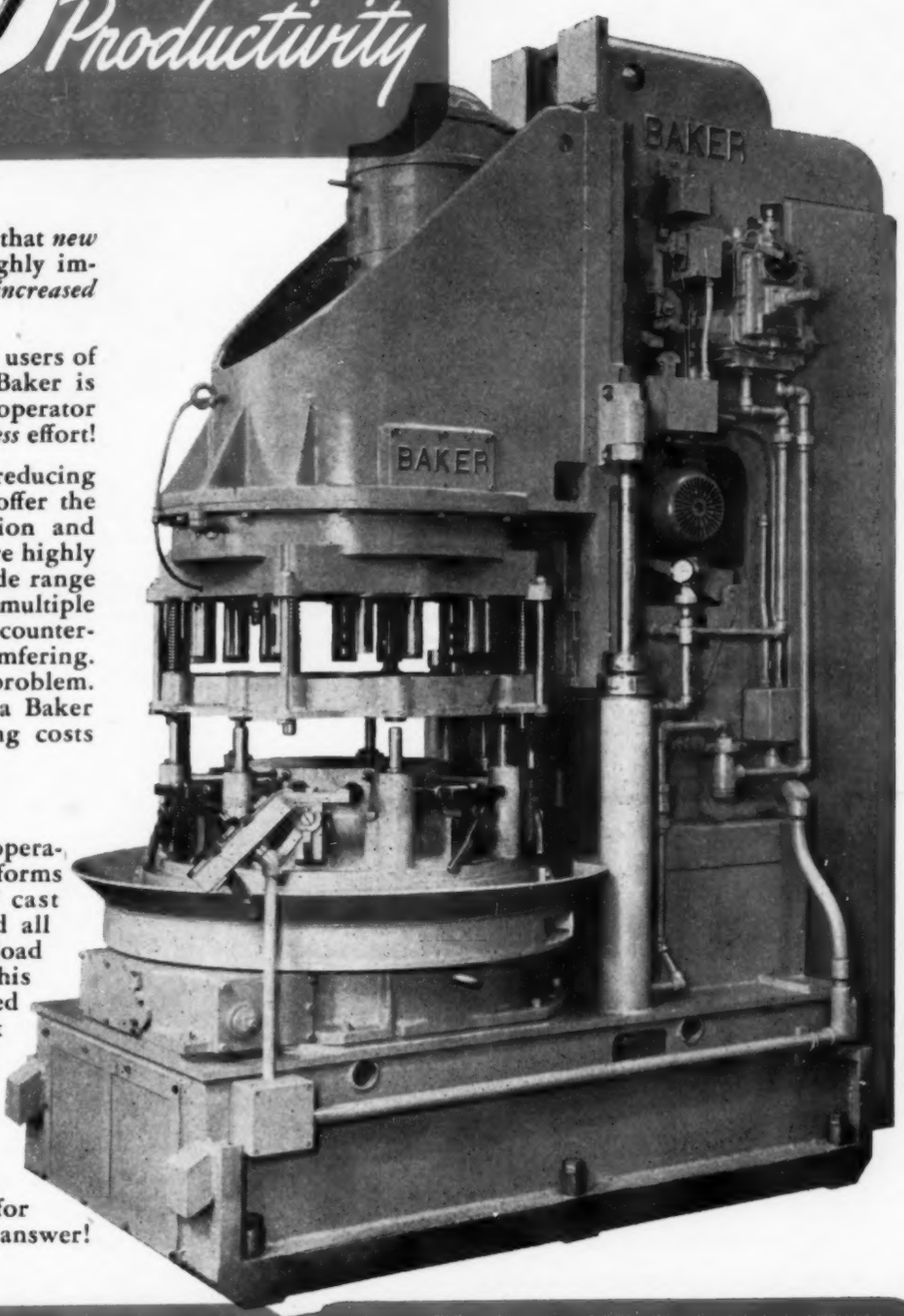
Here's rapid production on multi-operation work! This Baker 60 HO performs six steps in the completion of cast iron shock absorber bodies—and all the operator does is load and unload the part . . . and push a button. This multi-operation machine is equipped with an automatic power index table and an electric cycle control attachment. Extra-heavy-duty multiple spindle heads are furnished with the machine and spindles are mounted on ball bearings. This is one of countless drilling, tapping and boring problems for which Baker Machines are the *right* answer!



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DRILLING - BORING - TAPPING AND KEYSEATING MACHINES

+ INCREASED PRODUCTION
— REDUCED SETUP TIME
= DAYTON ROGERS DIE CUSHIONS

No matter how you figure it Dayton Rogers Die Cushions will assure better results and lower production costs on your punch press operations because:

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HUB POWER PRESS
With Motor Drives
for speed, accuracy and economy

These convenient, high speed, power presses will handle materials with ease and convenience. Assures high production of parts at lowest cost.

Made in 4½, 6 and 15 Ton Capacities.

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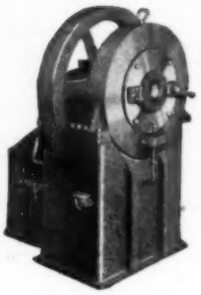

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TORRINGTON
ROTARY
SWAGING MACHINE

— with 4000 forceful squeezing hammer blows per minute—makes metal tougher and more elastic. Send for booklet—"The Torrington Swaging Machine."

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SELF-LOCKING NUTS

CAN YOU BE SURE THAT A PLAIN NUT WON'T SLYLY UNWIND ITSELF? If not, then what you need is the All-metal, One-piece "Flexloc," which is a Self-Locking Nut that won't budge, except when a wrench is used.

"Flexloc" packs maximum usefulness in minimum space because it is rugged, locked, compact—and is therefore, becoming increasingly popular and this applies alike to U.S.S. and S.A.E. thread series. Every thread—including the locking threads—takes its share of the load.

Covers a wide range of tolerances—from low #1 to high #3. Can be used over and over again without losing much of its locking ability.

Being a "stop" nut, it stays locked in any position on a threaded member.

"Flexloc" Thin Nuts are especially popular, because their tensile is so high.

Sizes from #6 to 1" in diameter—millions in use!

Convince yourself with a few free samples

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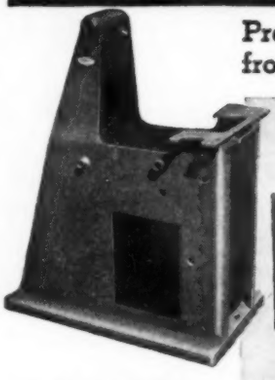

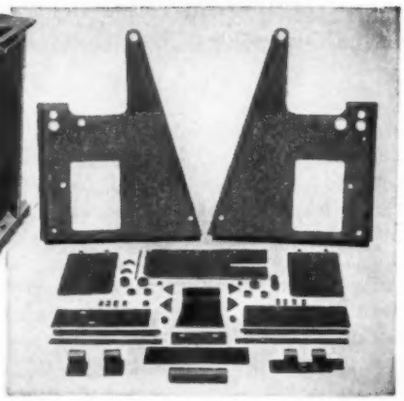

Reduced Machining Costs, Rejects, Handling and Freight Costs

Completely replacing heavy, unreliable castings, Fab-Welded Machine Frames and Bases of intricate design are built up from accurately made parts, jig-welded, and produced on a quantity basis.

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SKINNER Chuck NEWS

THE CREST OF QUALITY

PUBLISHED BY THE SKINNER CHUCK COMPANY, 343 CHURCH ST., NEW BRITAIN, CONN.

DISSA and DATA

When setting up work that must be cleaned up on more than one surface, the piece should be trued up with reference to the surface on which there is the least amount of metal to be removed or which must be finished most accurately to size. For example in chucking a pulley casting, if there is ample material to be taken off the center hole and only a slight finish allowed on the rim, true up the pulley by the rim.

The ideal chuck would be one possessing the rigidity of solid steel, at the same time retaining the adaptability of the human hand to grasp and hold firmly objects of various sizes and shapes. Such an ideal chuck is impossible, but all the better chucks of today are built with these principles in mind.

When a chuck with plate attached is screwed on a threaded spindle nose, be sure to oil either the spindle nose or the threaded surface of the plate, as if both surfaces are dry, the face plate may stick when removal is attempted.

SKINNER SERVICE

Did you know that Skinner takes stock inventory each week and sends the report to each of their dealers to aid them in serving you? Keep in touch with your local Skinner distributor for latest news on Skinner products.

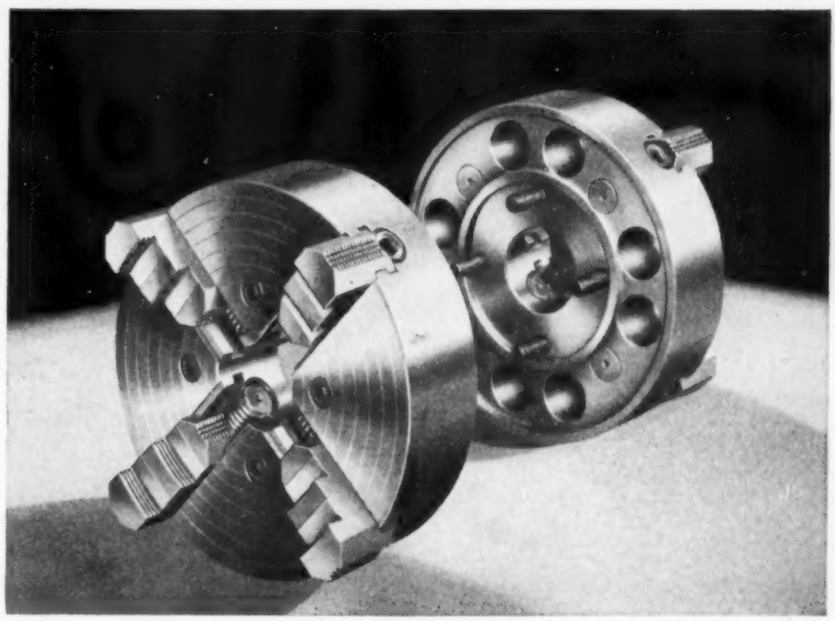
SKINNER chuckles

A bigamist is a man who has taken one too many.

A dime is a dollar with all the various taxes deducted.

An optimist is a fellow who doesn't know what's coming to him.

Skinner dealers are located in all principal cities — consult the one nearest you for complete details on Skinner products.

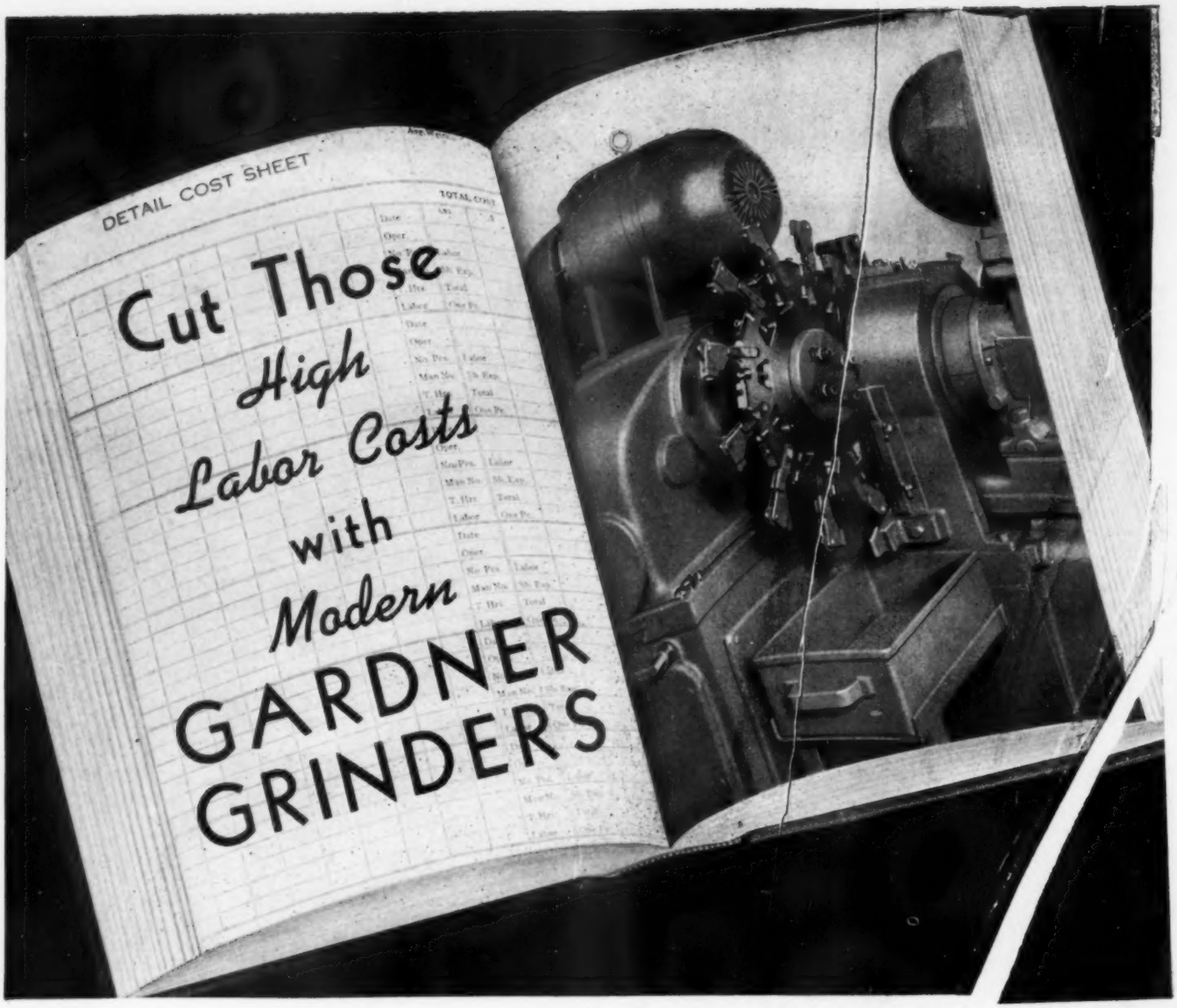


Skinner Series 1900 Independent Chuck

DESIGNED FOR HEAVY PRECISION WORK
Skinner Steel Body Independent Chucks in Models to Suit Every Spindle Nose

New Britain, Conn.—Series 1900 Independent Chucks are especially designed for use on engine and tool room lathes handling heavy precision work. These chucks are proven producers throughout the nation in manufacturing plants and railroad shops. They have such features as rugged, balanced, forged steel bodies capable of withstanding the severest jaw pressures, solid, serrated jaws that can be used for gripping either internally or externally, and large, hardened steel thrust bearings to take the end thrust imposed on the operating screws. And, because independent chucks are so versatile, the Skinner 1900 Series is built in a wide variety of models designed for direct mounting on various types of spindle noses. The 1900-D and 21900-D are for use with cam lock type D-1 spindle noses; the 1900-L and 21900-L for long taper key drive type L spindles; Models 1900-A, 21900-A and 29900-A for direct mounting on American Standard Type A-1, A-2, B-1, B-2 flanged spindle noses. For mounting on lathes with threaded spindle noses by means of intermediate adaptor plates, Skinner makes two models—the 1900 and 21900. A further advantage of Skinner Steel Body Independent Chucks is that they are available for early delivery. Complete information on all of these Chucks is contained in Catalog No. 59—write for it today.

HAND & POWER OPERATED MACHINE CHUCKS—AIR CHUCK EQUIPMENT —FACE PLATE JAWS—MACHINE VISES



HIGH labor costs can be cut best with high-production tools. Many production operations on flat surface jobs can be speeded up with GARDNER GRINDERS equipped with time-saving, labor-lightening, special quick-loading and unloading fixtures.

Here's an example—a Gardner No. 115-15" Double Spindle Grinder that grinds four sides of the heads of steel spring retainer buttons—TWO sides at a time. PRODUCTION: 15 to 20 cuts per minute. TOLERANCES: .002" for par allelism; .001" for squareness; .005" for unifo mity. STOCK REMOVAL: .010" to .014" overall. FEEDING: Hand load to rotary carrier; gravity unload.

Installation of *Modern* GARDNER GRINDERS *will prove profitable* because these newer, up-to-date machines enable your operators to turn out more precision-ground pieces per minute—and down come those high labor costs!!

Write for Special 8-page Bulletin!

GARDNER-GRIND YOUR *Flat* SURFACES

GARDNER MACHINE COMPANY

410 East Gardner Street . . . . Beloit, Wisconsin, U.S.A.

FOR

HEAVY STOCK REMOVAL

To settle all doubt—

MICROHONING CUTS CHIPS! MICROHONING IS METAL CUTTING!

These Are Microhoned Honing Chips—

Millions—Billions—of such small scale chips are cut by the many thousands of face contacting grits in an average 3 to 6 stone set of honing stones—all cutting at the same time. Combined—they can remove a lot of metal—up to .080″ on diameter—in a relatively short time—or at rate of .006″ to .008″ per minute.

This means that high production now has a new method of short-cutting time cost by honing from the green bore—hardening—and finish honing—with elimination of intermediate bore machining operations.

It is economical in other ways. New additive treatments in Micromatic Honing Stones yield from 200% to 400% more bores per set of stones than was formerly possible.

MICROMATIC HONE CORPORATION • DETROIT 4, MICHIGAN

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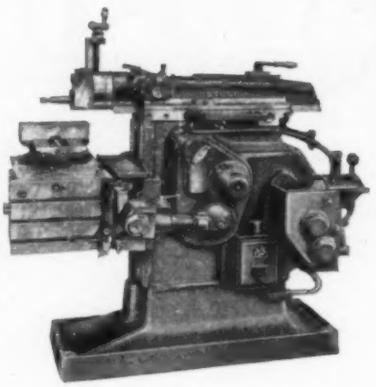
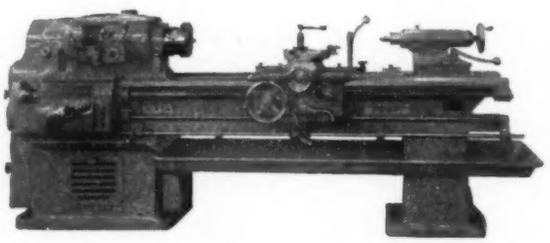


Hendey 12" shaper

THERE'S NO SUBSTITUTE . . .

. . . for the hand and eye of an experienced workman—and, when he's guided by the philosophy that a machine tool must be built to the highest standards of precision workmanship, the result can only be a better machine. For over 75 years Hendey has been building machine tools. Today, many of its machinists are sons or grandsons of men who grew up with Hendey. Instilled in their minds is the philosophy of Henry J. Hendey, and over 75 years of invaluable experience is bred into their hands. That's why today we can invite you to compare the productive capacity and precision of a Hendey machine with any other similar machine on the market.



Hendey 18 speed Precision Tool room Lathe

Complete details on request

The Hendey Machine Company

Hendey

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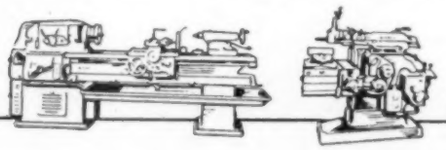


TOOL ROOM LATHES
12" - 14" - 16" - 18" - 20"

SHAPERS
12" - 16" - 20"

SHELDON

precision

SHELDON S-56
11¼" swing
1" collet capacity
56" bed

SHELDON *precision* is of the new type; is the precision of modern manufacturing methods —a specially designed machine tool plant, tooled to the nth degree with the finest machine-tool building equipment. From this plant come precision lathes, milling machines and shapers—quality machine tools built to the closest tolerances on a quantity production basis much like a fine aircraft engine.

Possibly equally accurate tools can be built "by hand" but only at far greater cost.

That is why SHELDON can always give "more tools for the money"—more accuracy, more capacity, more features and inherent quality. That is why it is always smart to "See the Sheldon at your distributors before you buy."

Write for Catalog

See Our Exhibits at "Metal Show" Atlantic City, Nov. VR *to* BB
"Power Show" New York Dec. 2 to 7

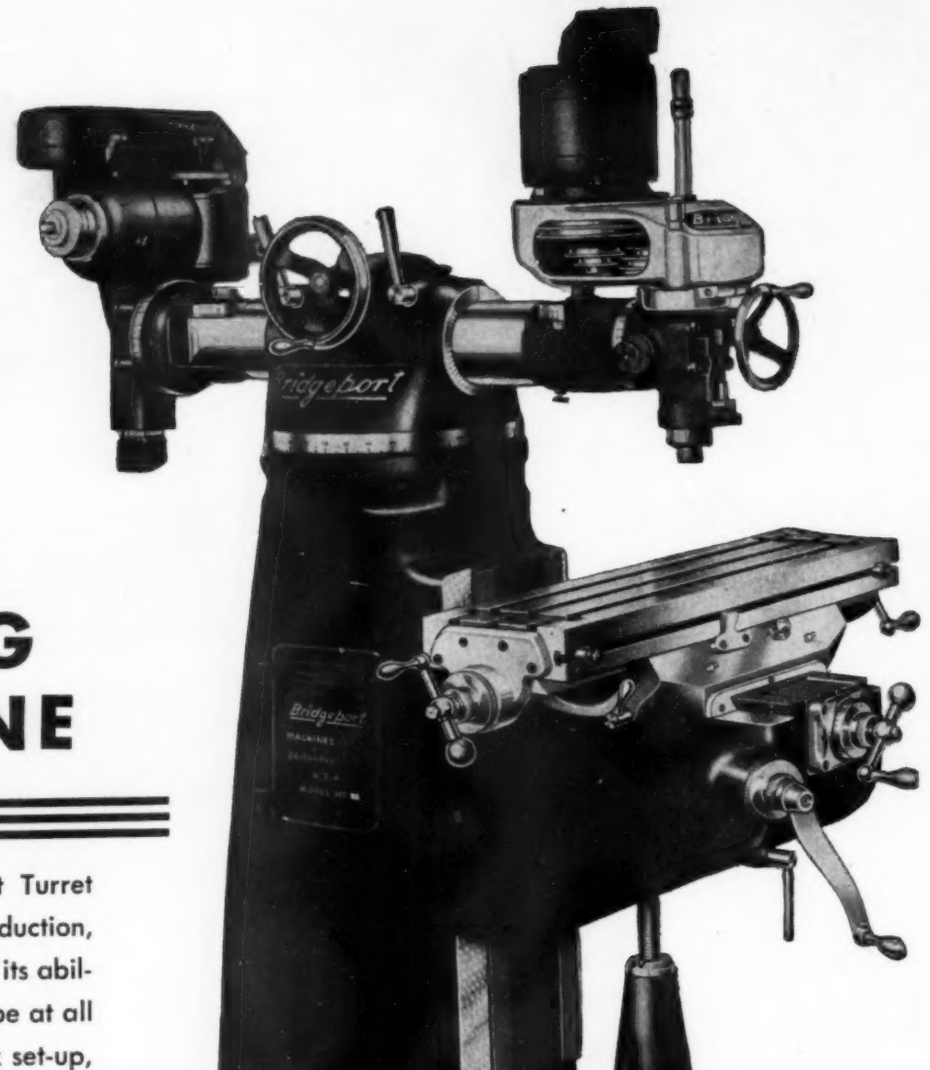
SHELDON MACHINE CO. Inc.

Manufacturers of Sheldon Precision Lathes • Arbor Presses • Vises
Sheldon-Vernon Horizontal Milling Machines • Vertical Milling Machines and Jig Borers • Shapers

4234 N. KNOX AVENUE • CHICAGO 41, ILLINOIS, U.S.A.

Bridgeport

TURRET MILLING MACHINE



The fact that the Bridgeport Turret Milling Machine speeds production, cuts time and reduces costs by its ability to mill, drill, bore and shape at all angles and with a single work set-up, makes a lot of present equipment obsolete. To replace ancient machines with "Bridgeports" is to render a service to the steel mills who sorely need scrap and to the shop who needs lower cost production. Why not help the scrap drive and yourself at the same time by putting "Bridgeports" to work. Investigate.

●

SPECIFICATIONS

Longitudinal Feed—20"
Cross Feed—9"
Vertical Feed of Knee—16"
Standard Table—9" x 32"
Special Tables up to 48" available; also longitudinal power feed
Weight with Shaping Unit—2000 lbs.

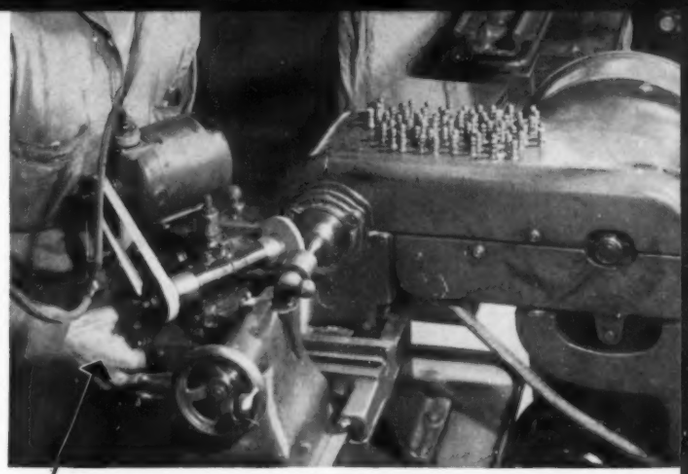
Investigate TODAY

Bridgeport

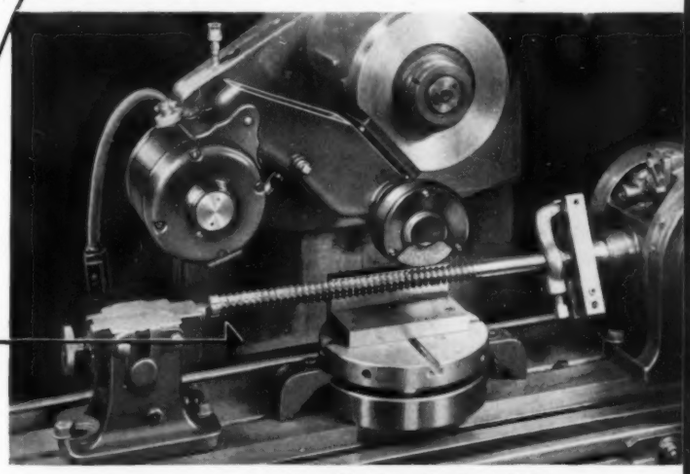
MACHINES, INC.
BRIDGEPORT
CONN.

Any basic machine tool plus a Dumore is a *Cost-cutting Precision Grinder*

for your { production, toolroom, or maintenance shop }



Production —Curlemont Corp., Chicago, Illinois, made out on poppet-valve production with line of No. 44 Dumores mounted on lathes, after 8 shops with more expensive equipment failed.

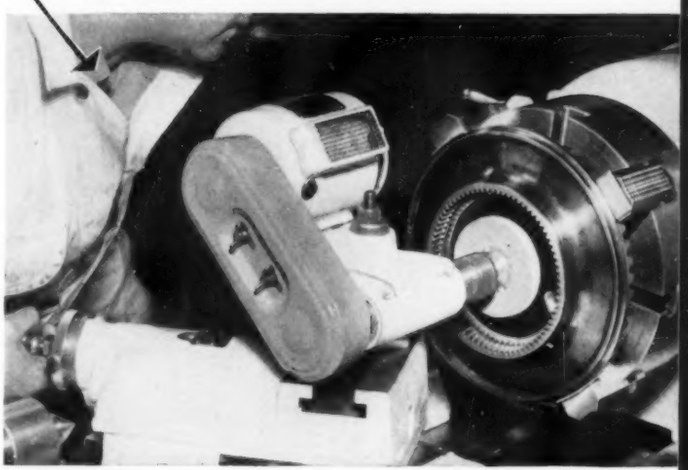


Toolroom —Zagar Tool Co., Cleveland, Ohio uses No. 7 Dumore on Brown and Sharpe Surface Grinder in place of standard head, to provide high-speed accuracy required in broach grinding.

Actual case studies made in many plants prove you can often avoid heavy investment in special machines by using versatile Dumore Grinders. They convert basic machine tools — equipment you already have — into dependable precision grinders for cylindrical, surface, tool, and thread grinding.

The low initial cost and minimum maintenance requirements of a Dumore deserve serious consideration in your cost-cutting and methods-improvement program. In your toolroom and maintenance shop, a Dumore is indispensable because of its set-up speed and adaptability to a variety of different jobs in a single work day. Its dependable stamina and versatility can be equally valuable in your production departments.

Use the coupon on the following page to get your free copy of *Here's How*, a book packed with reports on how 75 other plants have used Dumore Grinders to slash their grinding costs. See how you can cut your costs with Dumore too!



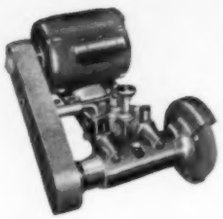
Maintenance — Northwest Airlines, St. Paul Shops, extends life of parts by chrome-plating worn surfaces and regrinding to exact size with high-precision Dumore No. 5 mounted in lathe compound.

DUMORE
PRECISION TOOLS

Sold by leading distributors in all principal cities.

Turn the page for information on the complete line of Dumore cost-cutting tools and grinders.

7 Different sizes and types of Precision Dumore Grinders

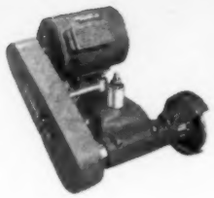


No. 12

— 1 HP; speeds 2800 to 7750 rpm.; wheel sizes — 3" to 8"; for external work and internal to 24" depths.

No. 77

— ½ HP; speeds 3400 to 13,800 rpm.; wheel sizes — 1" to 6"; for external work and internal to 18" depths.



No. 7

— ¾ HP; speeds 4200 to 29,300 rpm; wheel sizes — ⅛" to 5"; for external work and internal to 18" depths.

No. 5

—½ HP; speeds 4600 to 42,500 rpm.; wheel sizes — ⅛" to 5 "; for external work and internal to 18" depth.

No. 44

—¼ HP; speeds 6600 to 38,500 rpm.; wheel sizes — ⅛" to 3".

No. 11

— ⅓ HP; speeds 6900 to 30,000 rpm.; wheel sizes — ⅛" to 3".

No. 14

—1/14 HP; speeds 10,000 and 22,500 rpm.; wheel sizes ⅛" to 2"

There's a size and type Dumore for EVERY grinding need!

The complete line of Dumore precision grinders ranges from the husky 1 HP No. 12 to the tiny ¼ HP No. 14 — all capable of work to ± .0001" on production, toolroom, or maintenance jobs. Speeds up to 42,500 rpm. Interchangeable quills provide internal grinding capacity to 24" depths.

You can do every type of grinding job with a Dumore — internal and external cylindrical grinding, surface grinding, thread grinding, and tool or cutter grinding.

- **Dumores mount on any basic machine tool, converting it to a precision grinder.**
- **Dumores are used bench-mounted for off-hand or jig-and-fixture operations.**
- **Dumores serve as precision, high-speed work-heads on many special grinding machines.**
- **Dumores mounted on used machine-tool bases provide inexpensive, dependable grinding facilities.**

Send in the coupon below for your free copy of the new 76-page case-study book — showing how 75 other companies have used Dumore tools and grinders to cut their production, toolroom, and maintenance costs.

See preceding page for cost-cutting Dumore Grinder applications.

DUMORE
PRECISION TOOLS

Tear out and mail this coupon today!

THE DUMORE COMPANY, Dept. B-14, Racine, Wisconsin

Please send me, without obligation, my copy of *Here's How*, your manual of the newest techniques in grinding.

Name ..... Position .....

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Address .....

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4 Different Dumore Handgrinders

No. 8 HG

— 1/20 HP; speed — 18,000 rpm.; ⅛" capacity chuck or Jacobs No. 0 Chuck, 0 to ⅛" capacity.

No. 10 HG

— 1/10 HP; speed—22,000 rpm.; ⅛" capacity chuck or Jacobs No. 0 Chuck, 0 to ⅛" capacity.

No. 9 HG

— ¼ HP; speed — 15,500 rpm.; ¼" capacity chuck and extension arbor.

Duplex

— 1/14 HP; speed—17,000 rpm.; ¼" capacity chuck with ⅛" and 3/32" adapters; flexible shaft attachment.

Plus

Sensitive Drill

— 1/30 HP; speeds 2000 to 15,000 rpm.; Jacobs No. 0 Chuck, 0 to ⅛" capacity. With foot rheostat to control speed.

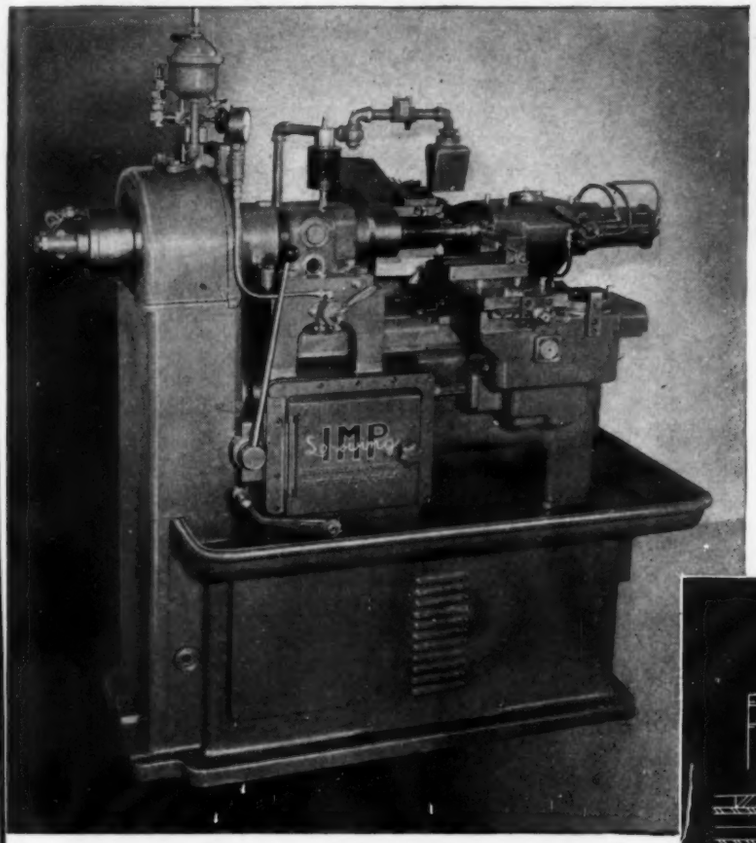
No. 2 Flexible Shaft Tool

— 1/15 HP; speeds 500 to 10,000 rpm.; Jacobs No. 0 Chuck, 0 to ⅛" capacity. With foot rheostat to control speed.

G-5

MACHINE OF THE MONTH

PARED BY THE SENECA FALLS MACHINE CO. "THE *Lo-swing* PEOPLE" SENECA FALLS, NEW YORK

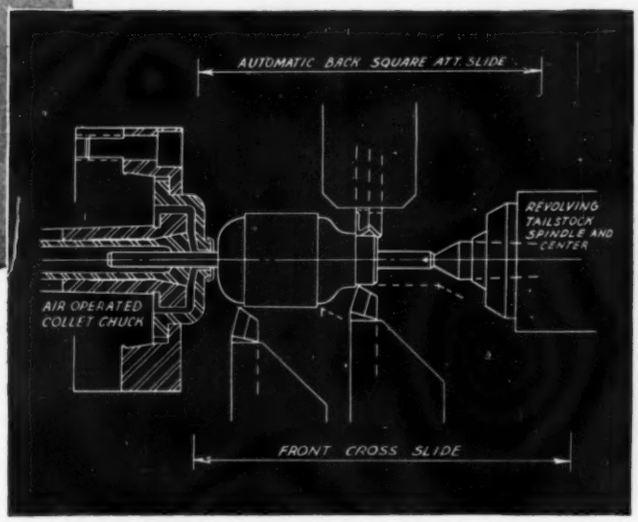


ROTOR AND STARTER COMMUTATORS

Automatically MACHINED

TO HIGH ACCURACY AND FINISH ON

Lo-swing IMP



PROBLEM: To automatically turn, chamfer and face electric motor rotor and starter commutators, maintaining a fine finish and extremely close tolerances.

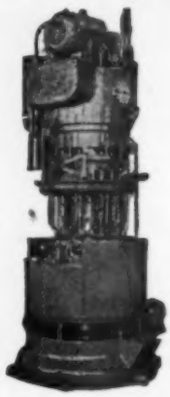
SOLUTION: The Lo-swing IMP Lathe with special equipment was selected for this job primarily because of inherent design features which permit high spindle speeds and unusual turning accuracy.

The work is held and driven from one of the ball-bearing seats of the shaft with an air-operated collet chuck. The tailstock end is supported on a revolving center, the movement of which is actuated by an air cylinder. This method of holding and driving the rotor assures the close concentricity which is required between the bearing seats and the O. D. of the commutator. The operation consists of turning the O. D. of the commutator and rotor, the facing of the shoulder (which is part of the commutator) and the chamfering of the shoulder.

Several other Lo-swing set-ups have been developed for this type of work. We suggest you send in your prints for our estimate.

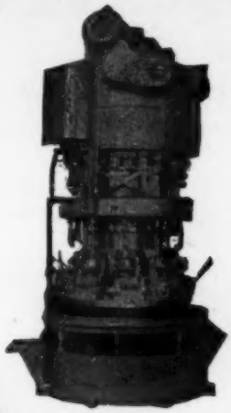
SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

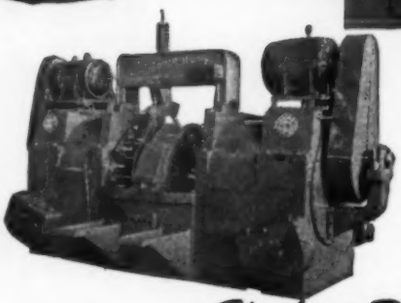
THE NEWS from SENECA FALLS



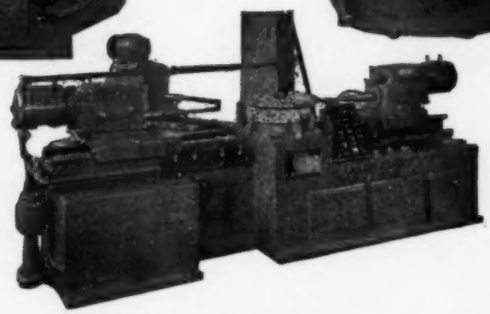
Roto-Matic Drilling MACHINES

VERTICAL AND HORIZONTAL TYPES





MULTIPLE SPINDLES



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MANUFACTURERS MACHINE TOOLS, MICROMETERS AND GAGES

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BRADFORD *Admiral* GRINDERS

The Quality Line that's tops in Performance!

These low-priced grinders are engineered with Bradford skill and experience. The machine illustrated is a combination buffer and grinder, 1 to 5 H. P. Also, a complete line of bench grinders.

Manufacturers also of drills, polishers, sanders, buffers, lathes, and cam feed unit type equipment.

1840–1947

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CINCINNATI, OHIO, U. S. A.

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CINCINNATI, OHIO

GENTLEMEN: Please send without obligation complete information on the Bradford line.

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The NEW M&N HOBBING PRESS

meets every demand for accuracy and easy control

Hydraulic . . .

Compact . . .

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Heavy Duty . . . and completely Self-Contained

This modern NEW press offers such outstanding response and control of moving parts that objects requiring extreme exactness can be handled with utmost ease. Blanking, forming and drawing of heavy materials are operations for which this press is well adapted, in addition to its abilty to perform the hobbing demanded in up-to-date tool rooms and mold shops.

Features include: Compactness of design; completely self-contained with motor and pump in base; minimum floor space; power connection the only outside connection necessary.

Available in capacities from 30 to 400 tons. Full details on request.

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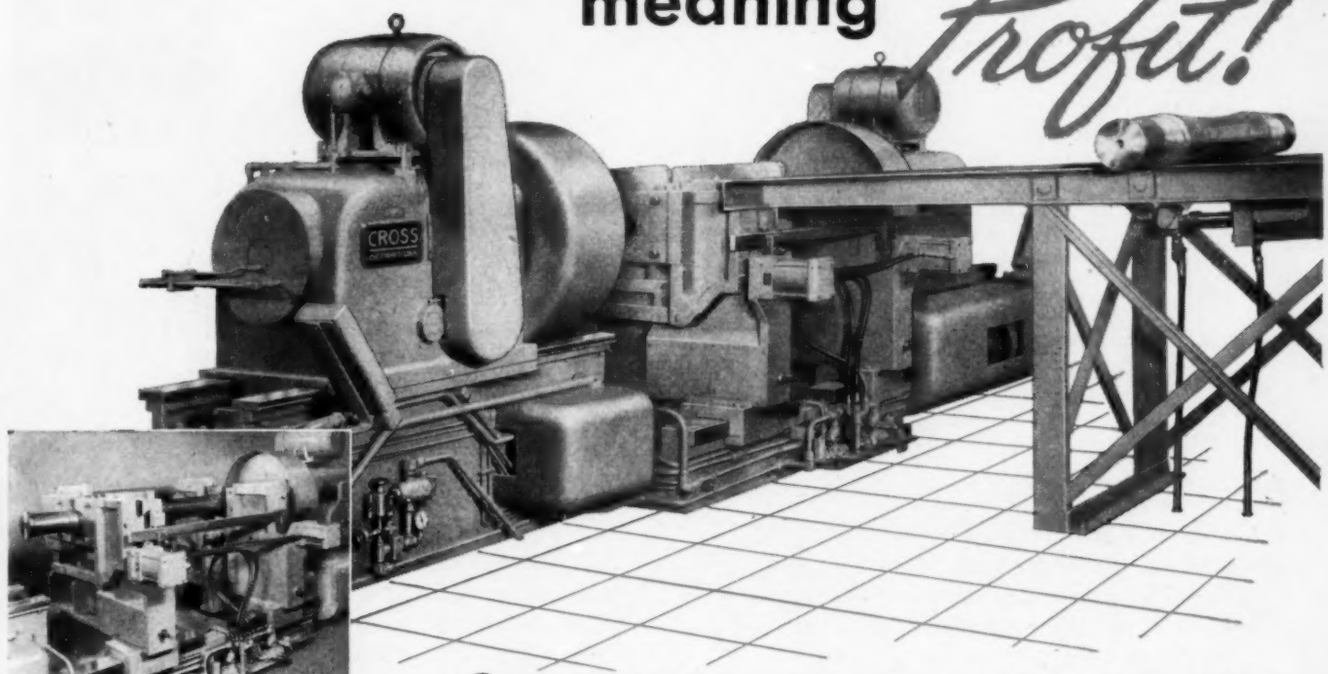
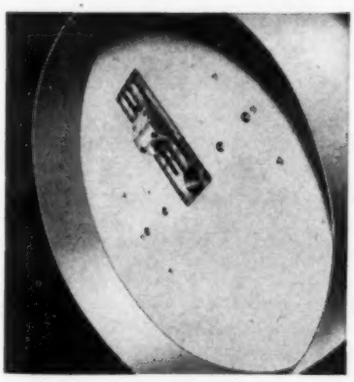
"Transfer-matic" — a 13 letter Cross-word meaning *Profit!*



After transfer, axle is lowered into position for clamping. Power actuated plungers in each spindle emerge to locate the part for length. Before cutting commences they retract.



Facing tool in each rotating head feeds inward to center and completes the operation. Both heads return quickly to starting position. Meanwhile the tools retract. Axle is held stationary.

Cross Machine Tools always have as their primary objective CONTROL OF COSTS TO INSURE PROFIT.

"Transfer-matic" is our one-word description for machining, loading, unloading, and transfer of the work piece from operation to operation.

Cross Transfer-matics combine automatic machining with power advancement of the work piece, from start to finish, through a programmed sequence of operations. Man hours are drastically reduced because there is no hand loading and unloading between machines. Further, they eliminate the premium ordinarily paid for skill, and minimize the possibility of human error.

Shown above is one of five Transfer-matics designed and built for machining various sizes of railroad car axles. Operations are cutting off, centering, turning the journal and wheel seats, and smooth finish-facing both ends to length simultaneously at axle-a-minute rate.

Everyone agrees that control of production costs requires revolutionary methods, and anticipation of tomorrow's demands. But for the man who has the responsibility of getting the job done—*"tomorrow" is already here.*

THE **CROSS** COMPANY

Established 1898

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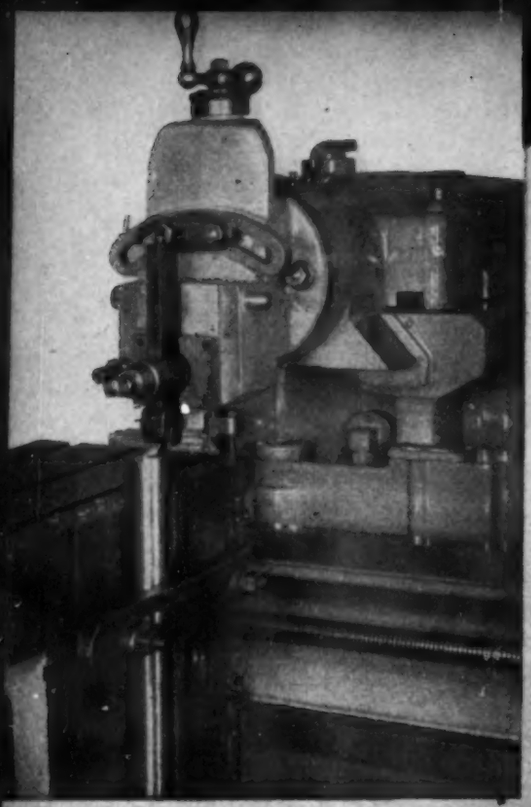
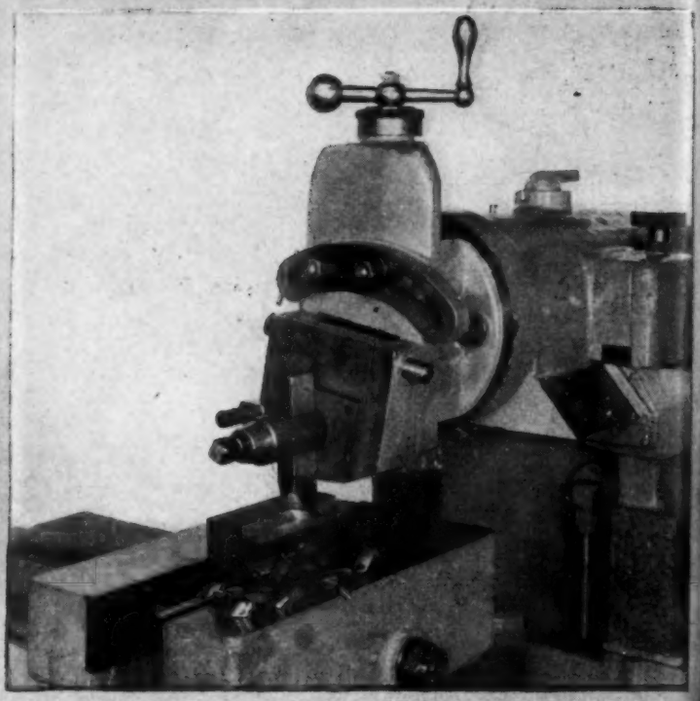
SPECIAL MACHINE TOOLS

DETROIT 7, MICHIGAN

MILLING • DRILLING • TAPPING • BORING • TURNING • SHAPING • GRINDING • HONING



SHORT STROKE . . . slotting keyway in end of shaft. Extremely short cutting and return strokes may be set at high speeds . . . without causing vibration or affecting smoothness of cut. Adjustment for any speed or stroke length is made quickly and easily by a simple setting of stroke adjustment levers . . . an important advantage in small lot production.



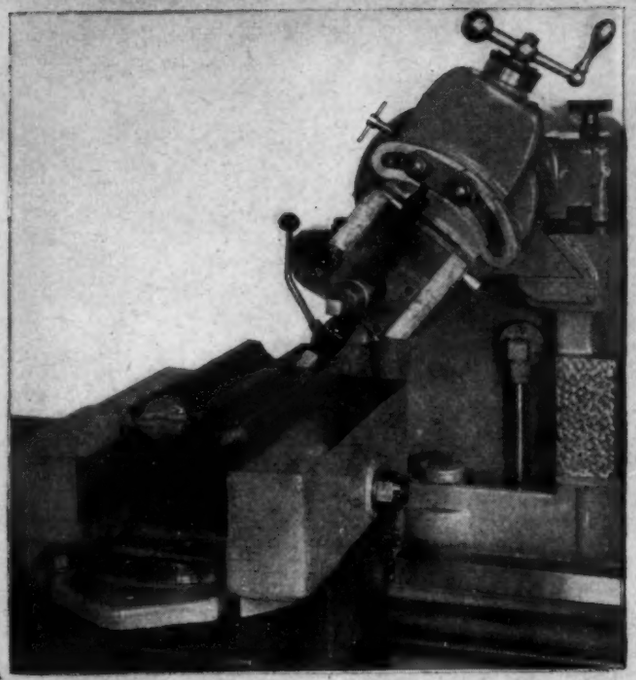
ROUGHING CUT . . . note size of chips. Rugged construction and abundant power make heavy-duty work an "every-day job" for a Rockford Hy-Draulic Shaper. Hy-Draulic design is also a safeguard against excessive feed and resultant overloading. The hydraulic system provides a predetermined maximum pressure, ample for every type of job; when an unsafe overload is met, ram will stop, as oil by-passes.

can you compete . . . ?

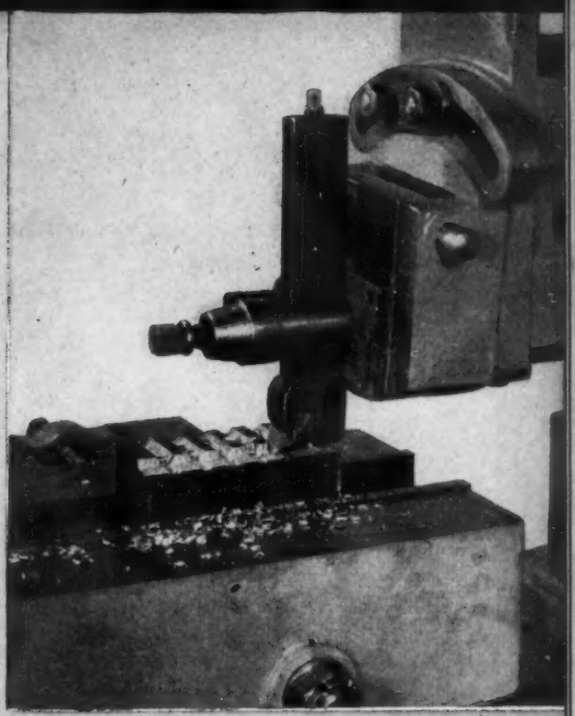
Why not make sure of your shaper equipment now. Ask yourself, could you compete with the work turned out on a new Rockford Hy-Draulic. Compare the work turned out on your present equipment with that of a champion in terms of cost, accuracy, operating ease or speed. Rockford Hy-Draulic Shapers give you accurate, infinite control of stroke and feed. They also give operating advantages that only Hy-Draulic design can provide. Put a Rockford Hy-Draulic Shaper through its paces and watch it perform on every type of shaper job. Write for Shaper Bulletin 442.

ROCKFORD MACHINE TOOL CO.
ROCKFORD ILLINOIS

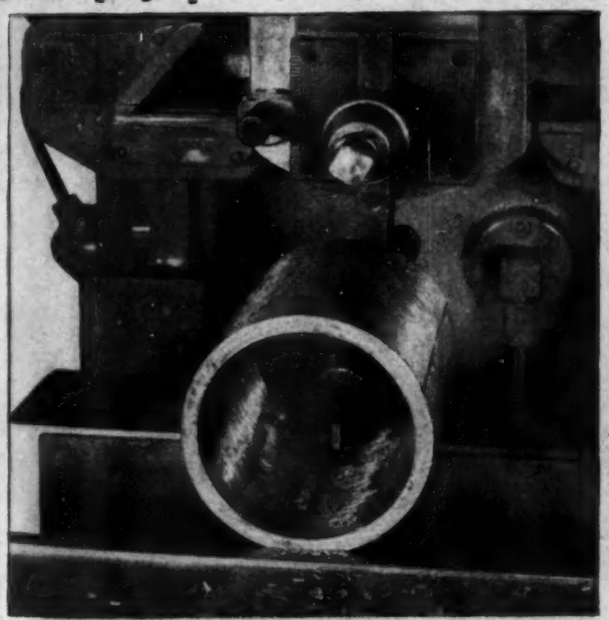
Hy-Draulic



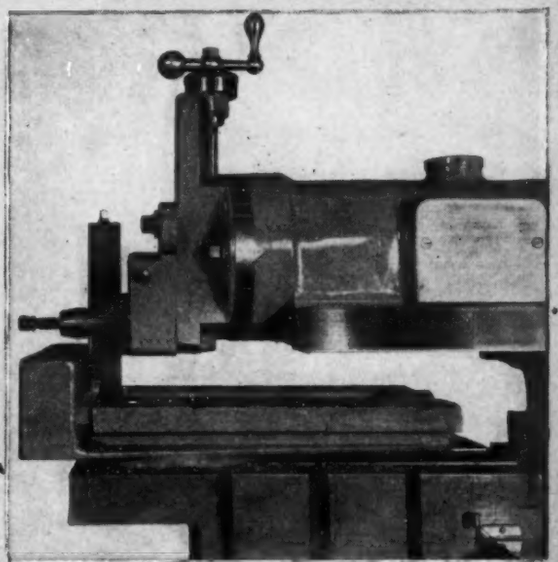
ANGLE CUT . . . cutting a dovetail on a slide. Precision of Rockford Hy-Draulic Shaper construction assures work accuracy and fine surface finish.



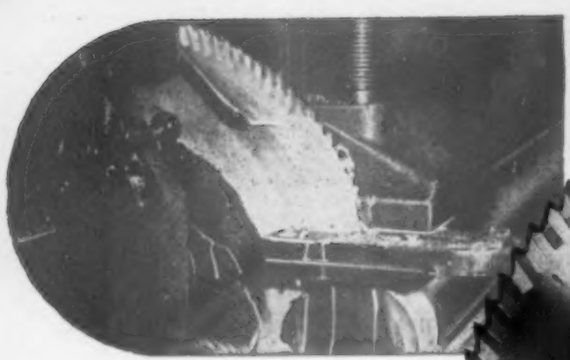
INTERMITTENT CUTTING . . . cushioning effect of hydraulic system makes interrupted cutting an easy operation for both tool and machine. Eliminates shock as tool enters each cut . . . protects tool against rapid wear and breakage.

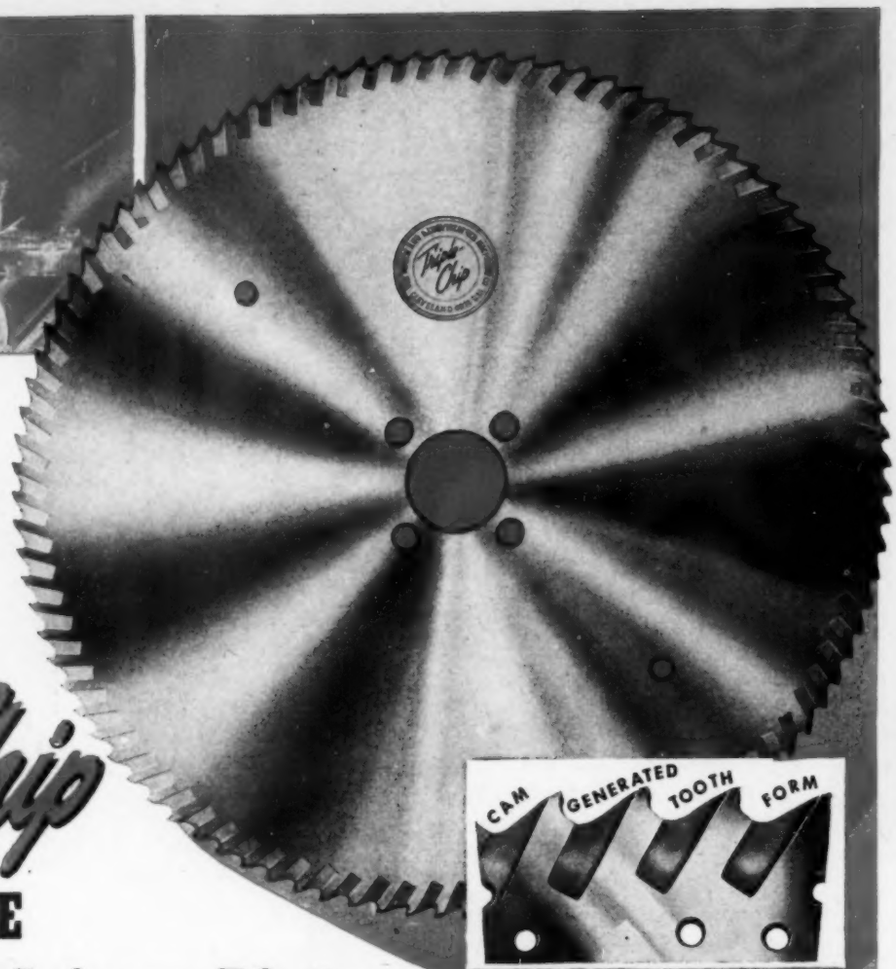


CUTTING TO A LINE . . . cutting keyway up to a drilled hole. As in the preceding illustration, this work set-up is an example of the accuracy in stroke length maintained by the new Rockford Hy-Draulic Shapers.



CUTTING TO A SHOULDER . . . this illustrates ability of shaper to maintain stroke length exactly. Whatever the stroke length or speed, it can be demonstrated that the new Rockford Hy-Draulic Shapers will cut-to-a-line with an accuracy far greater than required by any conventional shaper set-up.



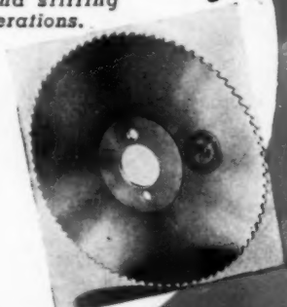


Now... Triple-Chip SAW BLADE ADVANTAGES from 70 Inches Dia. Down to 6".

Triple-Chip METHOD

Segmental type blades in large sizes (as above) and solid type blades in smaller sizes (as below), but all the well known advantages of the Triple-Chip Method in both types "all the way up and down". That means clean, burr-less sections, uniform and accurate; surprising speeds with surprising performance records; extremely long blade life per grind; the right blade for every job. Motch & Merryweather Triple-Chip Blades team up with M. & M. Circular Sawing Machines to give the very finest results; they fit other makes, too. Also, Motch & Merryweather Automatic Blade Sharpening Machines impart the correct cam-generated tooth form for maximum efficiency. *Only M. & M. builds all three.*

M. & M. Triple-Chip Saw Blades excel for numerous milling and slitting operations.



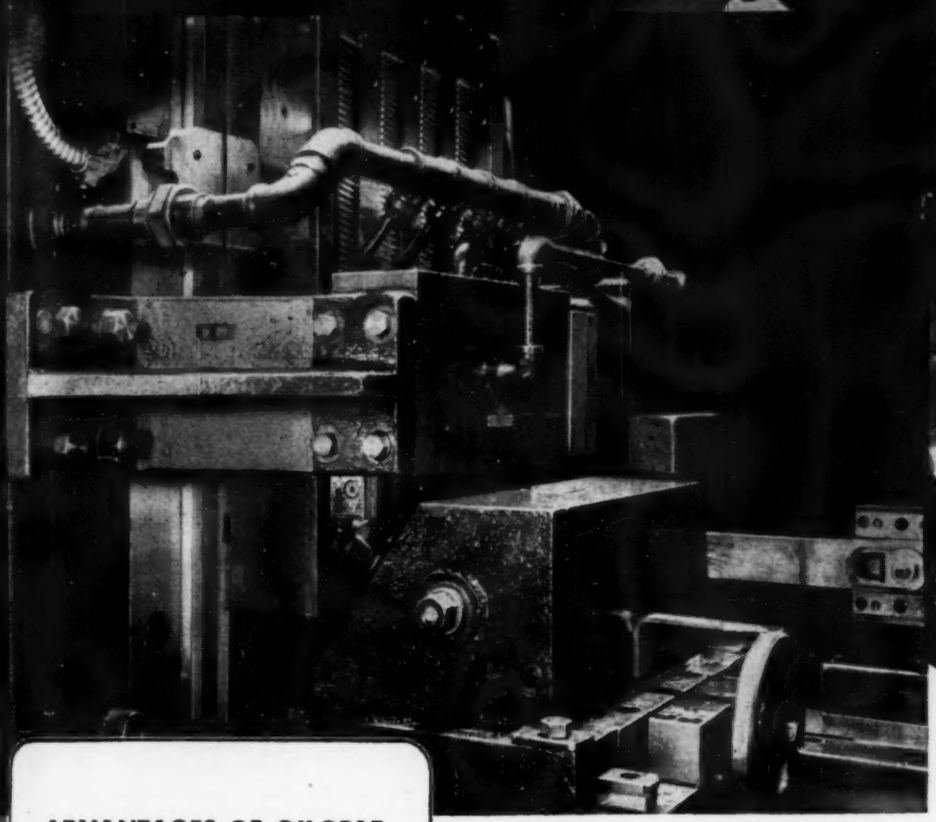
A Motch & Merryweather engineer is always at your service to discuss your requirements with you.

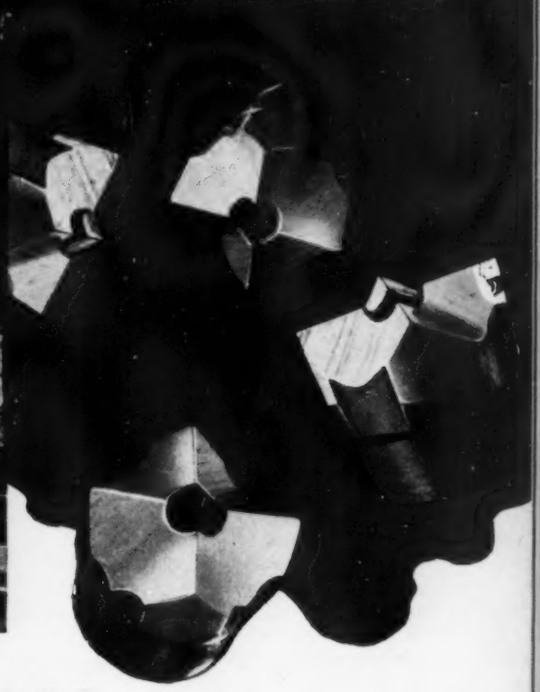
Only M & M builds ALL 3: COLD SAW SAW BLADE BLADE GRINDER

THE MOTCH & MERRYWEATHER MACHINERY CO.
PENTON BUILDING CLEVELAND 13, OHIO

MORE GOLD...

with Oilgear Fluid Power Broaching





ADVANTAGES OF OILGEAR BROACHING MACHINES

High broaching speeds, higher return speeds. Infinitely adjustable cutting and return speeds. More efficient use of electric power permitting smaller motors. More efficient use of the fluid medium, allowing oil reservoirs as little as 1/5th the size of others; more compact and usable machines. Wide and roomy tool slides and shuttle tables, manual, semi-automatic and full-automatic cycle control at no extra cost. Positive control interlock with fixture operation.

OILGEAR

In 1938, an Oilgear Surface Broaching Machine was sent up into the wilds of Canada, hundreds of miles from anywhere. It was to try its hand at sharpening rock drill bits used in Hollinger Consolidated Gold Mines Ltd. operations as against both hot milling and conventional steel sharpening.

Here is what happened: to date, this single machine has sharpened more than 4 million 551 thousand bits. It sharpens 175 bits per hour as against 70 by the hot milling method. With two men for the broaching and turning operations, it equals the output of three of the conventional steel sharpening machines with six men. Oilgear Broaching takes off less metal, yet gives sharper, cleaner edges, more efficient drilling. It averages 25,000 drill bits per tool regrind. Aside from a minor pump adjustment on March 18, 1939, it has required no maintenance whatsoever.

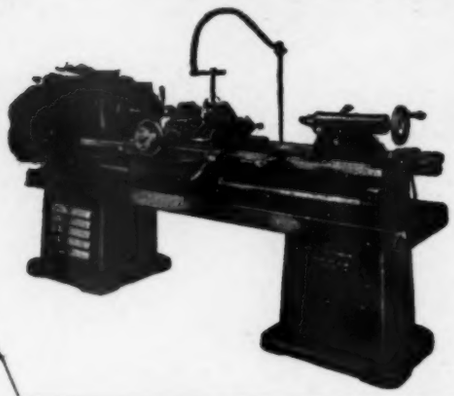
"(The) performance (of this Oilgear Broach) has been the main factor in our choice of another Oilgear machine for future operations," writes Mr. F. Wolnod of the Hollinger Company.

The gold you dig for may not come from mines. But you will get *more* "gold" if you turn to Oilgear Fluid Power Broaching. THE OILGEAR COMPANY, 1313 W. Bruce Street, Milwaukee 4, Wisconsin.

Oilgear manufactures a complete line of broaching machines . . . horizontal and vertical for every internal and external broaching operation.

Oilgear Fluid Power

40 YEARS OF EXPERIENCE produced
THE NEW COULTER
AUTOMATIC THREADING LATHE



The many different and number of threading tools which can be arranged on the tool slides both front and rear, make this machine the most versatile of any for production of square, standard, and 29 degree threads, both internal and external.

Equipped with disc clutch. . . . Easy to operate. . . . Rigid Construction. . . . Four speed headstock. . . . Return or Idle travel speed has been increased five times cutting speed.

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Grand Rapids No. 55 Surface Grinder

Faster precision production is possible with the exceptional table speed of Grand Rapids Hydraulic Feed Surface Grinders. Both longitudinal table travel and cross feed are automatic, hydraulic. Wheel head is powered for rapid vertical travel.

Write for Bulletin GL-101

GALLMEYER & LIVINGSTON COMPANY
Manufacturers of Grand Rapids Grinders
330 STRAIGHT ST., S. W., GRAND RAPIDS 4, MICH.

For cutting internal keyways, slots or splines 1/16" to 4" wide and up to 60" long. Fast—Accurate—Flexible. Write for particulars and catalog on machine for your work.

Giant KEYSEATERS
MITTS & MERRILL
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Sensitive DRILLING MACHINES
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ABRASIVE
ACCURACY BOOSTS PRODUCTION

No. 1G	INTERNAL GRINDER	No. 34	VERTICAL SPINDLE SURFACE GRINDER
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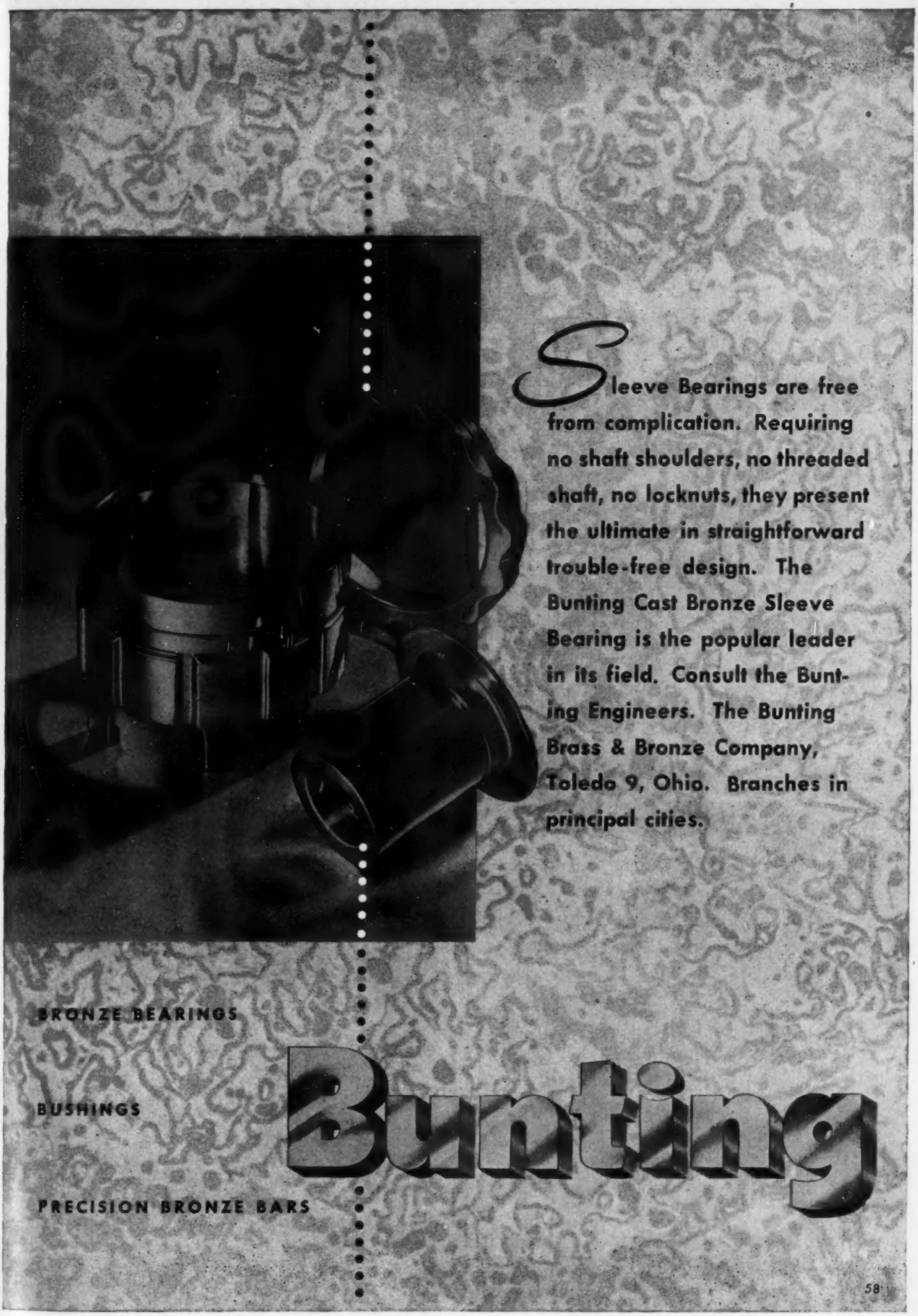
ABRASIVE MACHINE TOOL CO.
EAST PROVIDENCE 14, RHODE ISLAND


Sleeve Bearings are free from complication. Requiring no shaft shoulders, no threaded shaft, no locknuts, they present the ultimate in straightforward trouble-free design. The Bunting Cast Bronze Sleeve Bearing is the popular leader in its field. Consult the Bunting Engineers. The Bunting Brass & Bronze Company, Toledo 9, Ohio. Branches in principal cities.
BRONZE BEARINGS
BUSHINGS
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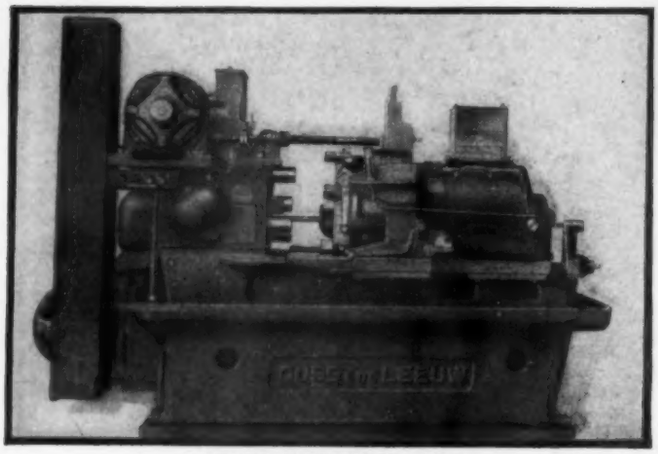
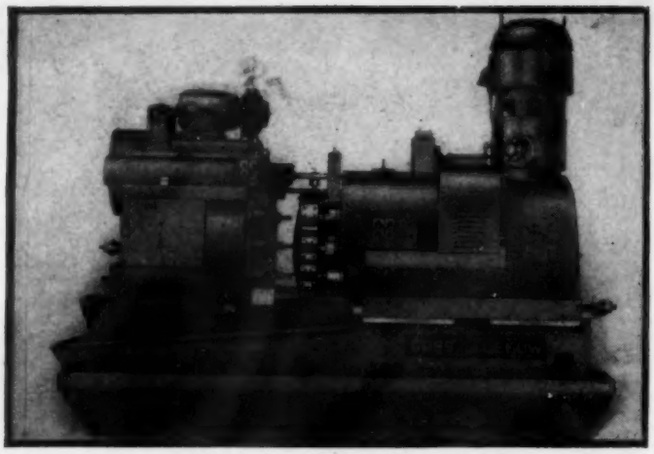
58

GOSS & DE LEEUW *Multiple Spindle* CHUCKING MACHINES



TOOL ROTATING TYPE

4 Spindles • 5 Chucking Positions



WORK ROTATING TYPE

5 spindles • 6 Spindles • 8 Spindles

Both types of machines provide lead screw threading. Oversize spindles on these machines are mounted on pre-loaded anti-friction bearings. Ways are hardened; gears are of chrome-nickel steel, carefully heat-treated.

The many modern features offered in these machines are fully described in catalog available on request.

GOSS & DE LEEUW MACHINE CO., NEW BRITAIN, CONN.

KEYSEATING
The Modern Way

Illustration shows typical set-up for cutting taper keyways with table tilted.

Machines are made in three sizes for keyways 1/16" to 1¼" in width.

Great simplicity and ease of operation of Davis Keyseaters assure the user of accurate, time saving work.

Let our engineer study your keyseating problems.

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If you have a SPECIAL PROBLEM

in any of these operations, where precision work is demanded and where greater production at man-hour savings is paramount—

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then a Moline Multiple Spindle Specially Designed machine tool is your answer. Moline tools are ruggedly built and engineered to fit your PARTICULAR requirements, they're made to last for years, they're easy to change over to other jobs, they do better work at less cost and stand up to it longer.

For YOUR special problem, go "HOLE-HOG," write us for any information you may need.

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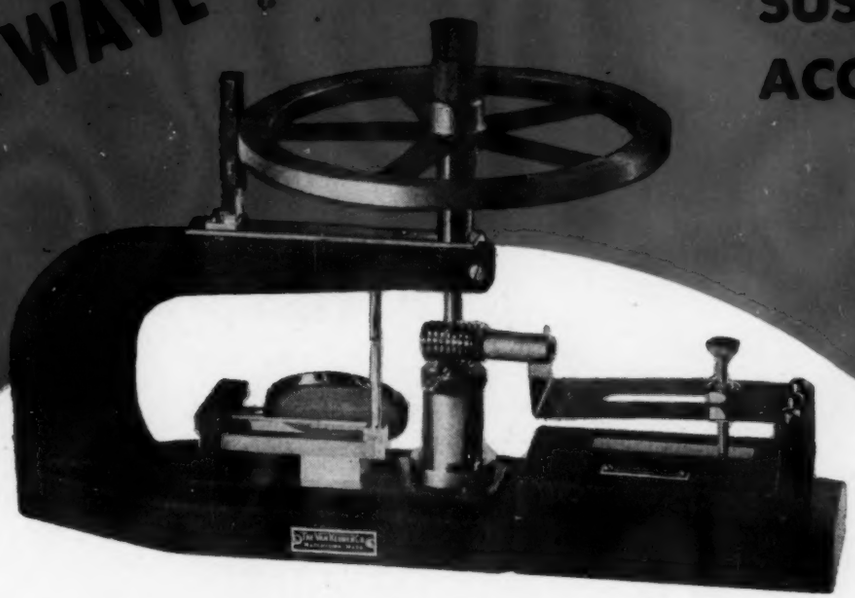
100 20th Street Moline, Illinois

Van Keuren LIGHT WAVE MICROMETER for SUSTAINED ACCURACY



NEW SYSTEM OF ACCURACY—The Van Keuren light wave micrometer is an instrument which has formed the basis for an entirely new method of maintaining high standards of accuracy. No gage blocks are required. Errors from worn gage blocks will not be constantly duplicated in the product.

A calibration chart showing the micrometer screw corrections to .00001" is furnished with each instrument. The new type of hardened and ground precision micrometer screw actually improves with use. Fine workmanship and carboloy wearing surfaces make the instrument accurate and dependable for years of constant service.

CONTROLLED PRESSURE ASSURES UNIFORMITY—By using the sensitivity of light waves the light wave micrometer insures the exact duplication of measuring pressure by any operator. This controlled pressure feature makes it possible to measure hard or soft materials, and for readings to be duplicated by different operators to .00001".

IDEAL FOR SHOP MEASUREMENTS—The light wave micrometer is ideal for making measurements by the 3 wire method, for measuring plug gages, measuring wires, precision parts and shop standards. It is a reference instrument. Forget about comparative measurements with gage blocks—use the light wave micrometer. It is fast, accurate and profitable.

The Van Keuren light wave micrometer is described in catalog No. 33. This book also gives complete tables and simplified formulas for measuring all standard threads, splines and spur gears. *Write for your copy!*

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27th YEAR

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Plug Gages • Carboloy Measuring Wires.

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780 PIECES AN HOUR

Part: Automotive Ball Stud.
Operation: Burnishing Ball Surface and Neck.
Ball Diameter: 7/8".
Material: Steel S.A.E. 3115.

Rolled on the **REED** Cylindrical-Die **THREAD ROLLER** Model A22

For complete specifications, write for Bulletin A22-1.

Prove it to your own satisfaction! Send us specifications of your work and let us roll samples. We will furnish production estimates and equipment costs.

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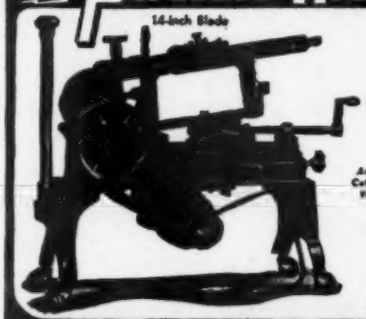
POWER HACK SAW



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FEATURES: 1. Low Hung Drive to Spindle. 2. All Power Driven Parts Running in Oil. 3. Quiet Running at all Speeds. 4. Concentrated and Convenient Push-button Controls. 5. Constructed on Unit Principle.

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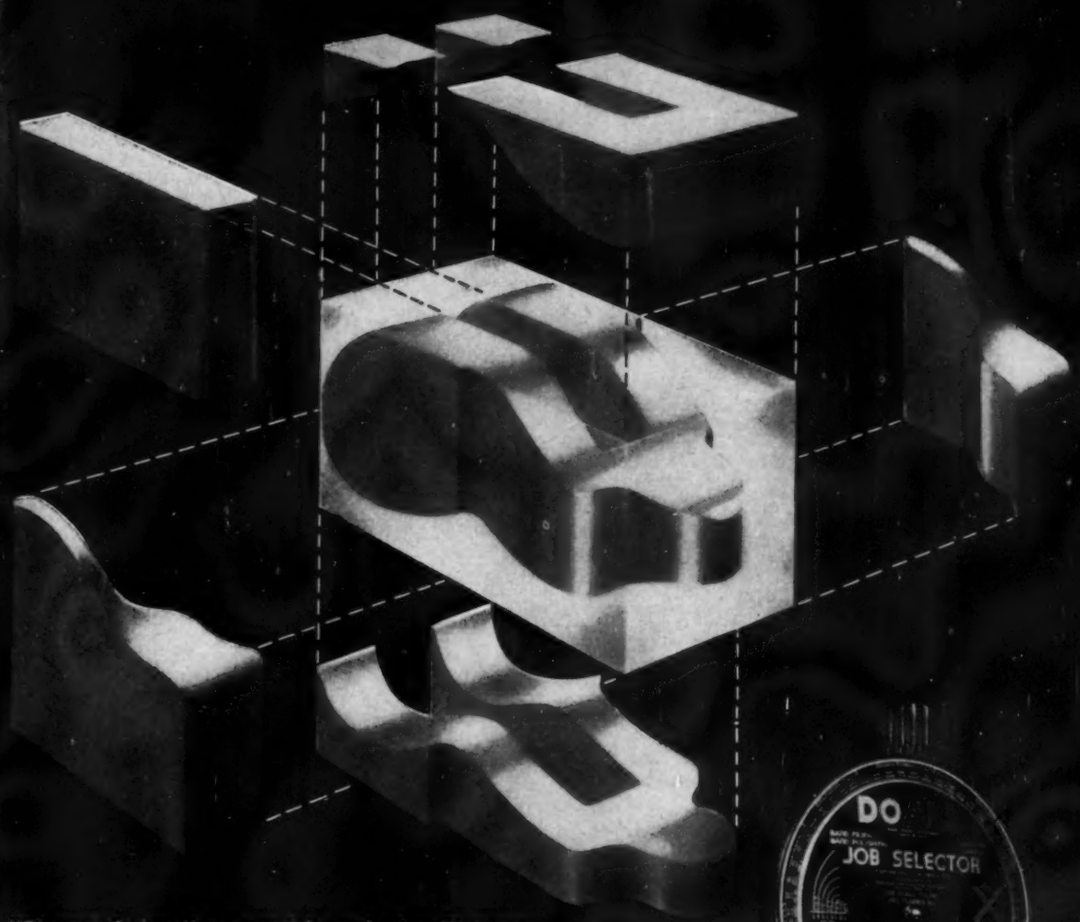
CINCINNATI 25, OHIO, U. S. A.

DoALL

METHOD OF LOW-COST PRODUCTION



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Seven Advantages of Contour Sawing

1—Usual work setup on machine eliminated.

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3—Cuts fast, continuously, straight or curved, internal as well as external. There is no time-wasting backstroke.

4—Infinitely varying speeds for greatest efficiency on different materials.

5—Valuable substitute for short-run casting or forging jobs.

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OAKITE *Special* PROTECTIVE OI

Humidity, acid or gaseous fumes, finger marks . . . these and other factors are primary causes of rust frequently found on ferrous parts after such operations as machining, grinding, drilling, sand blasting; brazing, tumbling, pickling. But there is a quick, low-cost, easy-to-apply rust-preventive that not only saves time and effort but also eliminates the trouble, extra work and expense of pre-drying before rust-proofing parts or surfaces that have been degreased and rinsed. For dependable in-door rust-prevention use Oakite Special Protective Oil!

Applied to surfaces by dip method, Oakite Special Protective Oil leaves a thin, transparent film of oil that protects precision finished surfaces, repels moisture and successfully inhibits rust formation. Does not discolor surfaces. Easy to remove when necessary. Use it to combat rust on screw machined parts, flat steel specialties, stamped and formed parts, bolts, nuts, gears, drills, dies, piston rings, saw blades and similar tools and parts.

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A 16-page booklet, free for the asking, describes various methods of applying Oakite Special Protective Oil, concentrations to use; gives summarized case-histories on its advantages and economies on many different types of work. This new booklet is sure to contain the answer to all your in-door rust-prevention problems, so write for your FREE copy TODAY!

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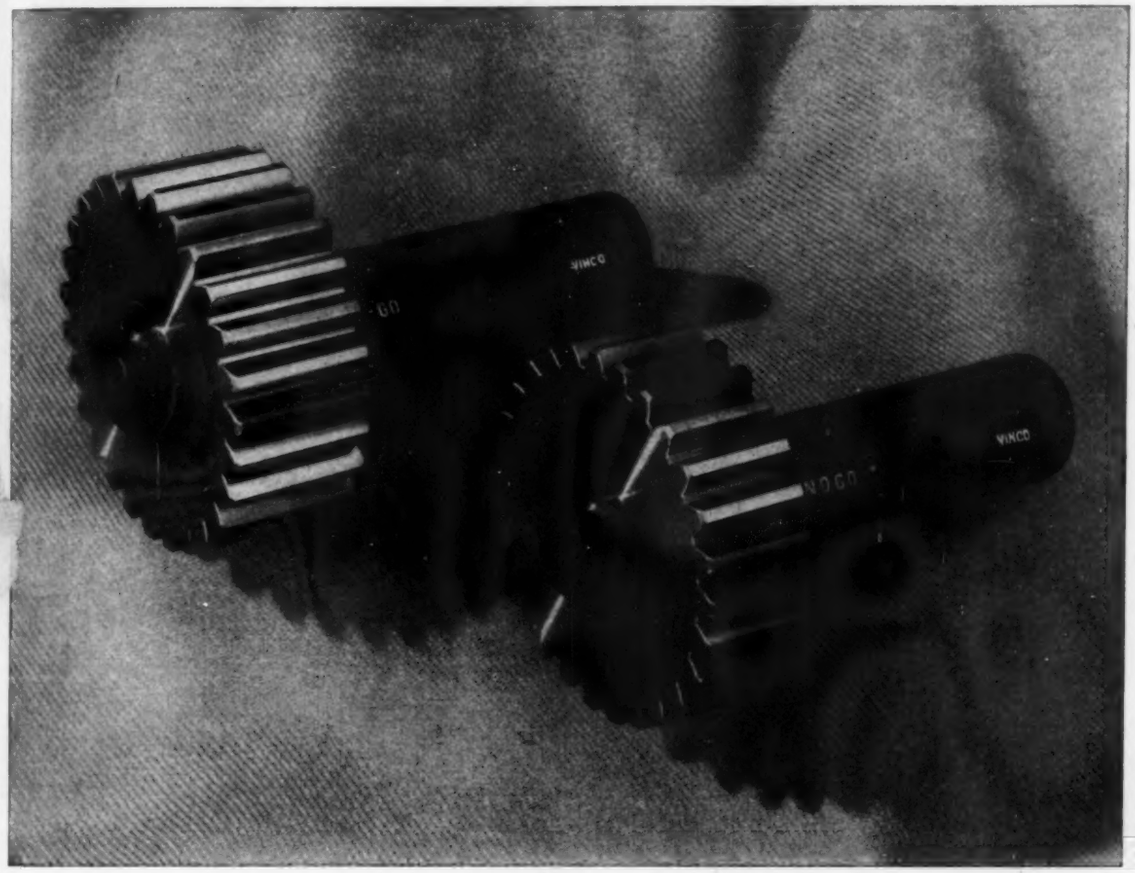

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VINCO Spline Gages, whether Involute, Serration or Straight Sided, will give you a true check of all essential spline tooth elements in the part. The consistent accuracy and quality of VINCO spline plug and ring gages are the result of more than twenty-five years devoted to developing equipment for controlling all gaging elements during production. That is why, today, VINCO is the acknowledged leader in the spline gage field, and, that is why you should specify spline plug and ring gages made by VINCO. Check with us at any time . . . we will gladly assist you in establishing a comprehensive and complete spline gaging policy.

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The OLIVER 510 DRILL POINTER

Most drilling operations performed are exacting —deep holes in solid metals—coarse feeds and high speeds that test the quality of tools and machines.

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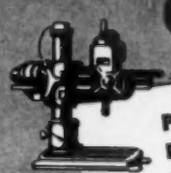
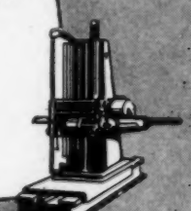


PRODUCTION SPEEDING RADIAL DRILLS AND HORIZONTAL DRILLING, BORING AND MILLING MACHINES



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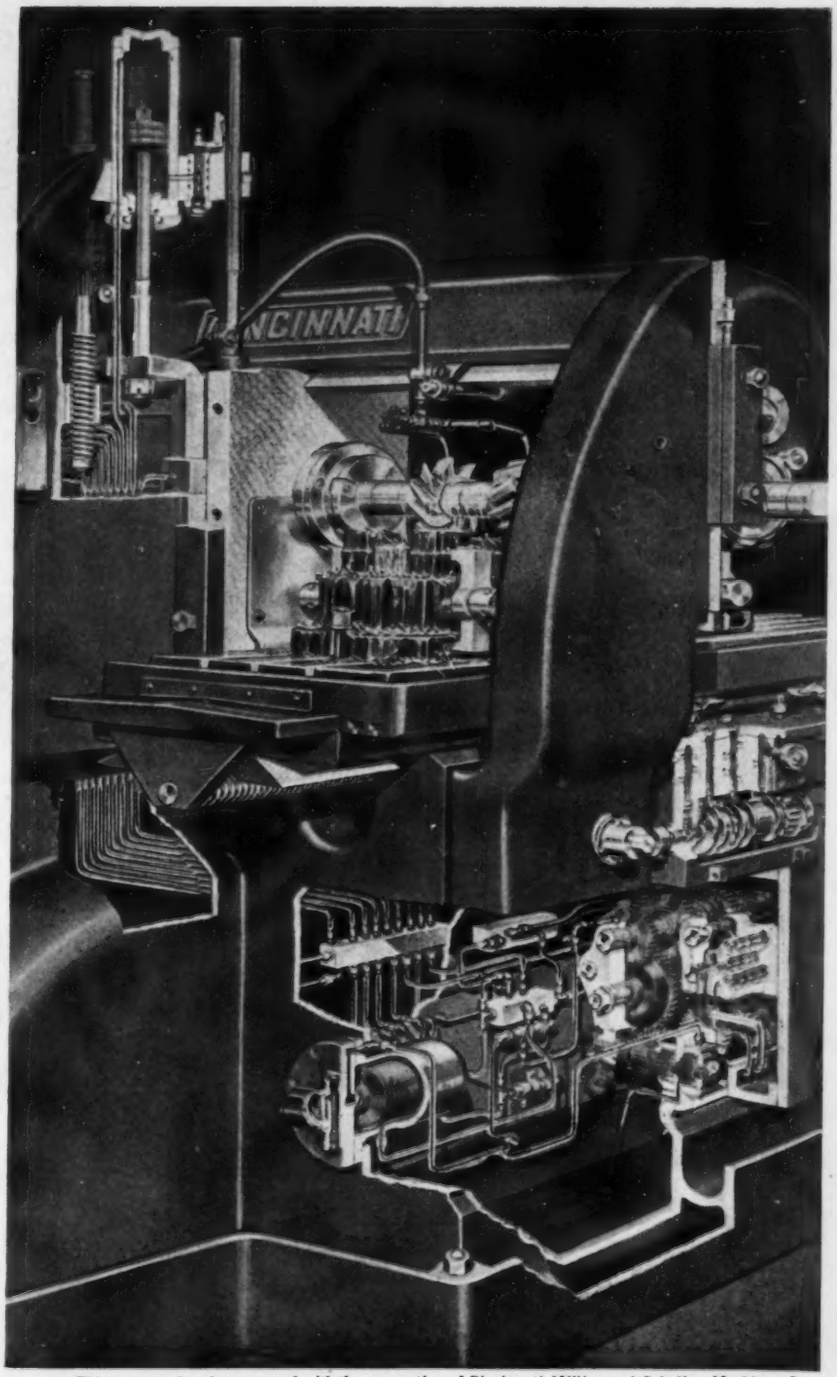

This cutaway drawing prepared with the cooperation of Cincinnati Milling and Grinding Machines, Inc.

COMPLETELY AUTOMATIC, this modern milling machine performs as many as 24 different functions.

It's all done with hydraulic controls. "Sinews" of oil transmit the power that governs the movements of the machine. This same oil also lubricates tableways, bearings and gears.

To assure continued accuracy of operation, this oil must possess exceptional stability to resist change over long periods. Appreciable change or the smallest deposits can affect the flow through small lines and interfere with smooth valve action.

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A Solution to

REPETITIVE PROFILE MILLING OPERATIONS

With GORTON and Tracer Control

THIS JOB IS COMPLETELY AUTOMATIC

This *Automatic* Milling and Indexing job was accomplished with a standard Gorton Pantograph with special fixtures—just one of many possibilities of tracer control milling.

Gorton Tracer Controlled equipment includes duplicators, pantographs and electric arc etchers for milling, engraving, etching and many other metal removal operations. This equipment provides high spindle speeds, wide versatility and high precision—characteristics for which Gorton has been known for more than fifty years. It will pay you to investigate Gorton Tracer Control methods now.

Standard Gorton Tracer Controlled 3-U Pantograph with special fixtures profiles turbine impeller blades in one *completely automatic cycle*

THE JOB IN BRIEF

1¾" O. D.

Name of Part—Turbine Impeller (dia. 1¾").
Material—Aluminum alloy.
Machine—Gorton Tracer Controlled 3-U Pantograph with special fixtures.
Operation—Mill 30 impeller blades in machined aluminum alloy blank with completely automatic feed and indexing.
Actual Cutting Time—1 minute per blade; 30 minutes per impeller.
Cutting Tools—.038" single flute cutter.
Remarks—Shape of cut determined by motorized master which drives the tracing stylus. Feed of cutter governed by special cam interlocked with indexing arrangement.

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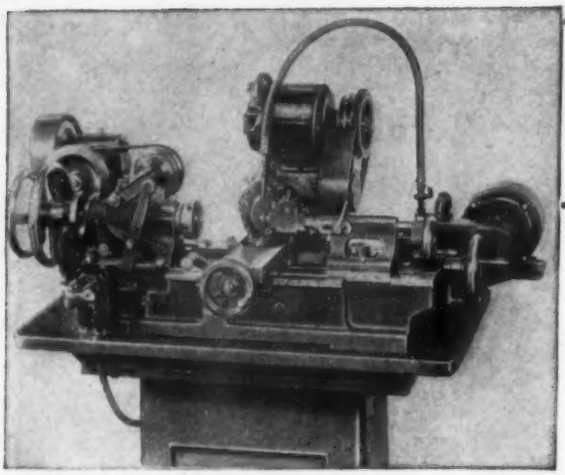

(Left)—Waltham Thread Miller equipped with Internal Threading Attachment.

•

(Below)—Waltham Thread Miller equipped with Relieving Head.

WALTHAM THREAD MILLERS

provide versatility and precision in small thread production

Designed especially for small work calling for close tolerances, WALTHAM THREAD MILLERS can be depended on to meet the most exacting specifications for precision parts.

An outstanding feature of these improved machines is the use of three motors, one each for driving cutter, work and pump. Machines can be arranged with speeds suitable for brass or steel or both. Motors are wired so that a single start and stop station will control all at one time.

Standard equipment includes three motors with control, follow rest, milling cutter, indexing device, 5 pitch lead screw and change gears for cutting from 5 to 40 threads per inch.

A wide range of special equipment is available and greatly enlarges the usefulness of this machine. Full details on request. Write for Bulletin 244A.

CONDENSED SPECIFICATIONS

Swing over carriage—3"
Dia. work handled—2" or smaller
Thread length (work held on centers) —8¾"
Thread length (work held in chuck)—10"
Max. Dist. between centers—12"
Floor Space—48"x34"
Net Weight—850 lbs.

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TRADE MARK REGISTERED U.S. PAT. OFF.

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MACHINE WORKS,
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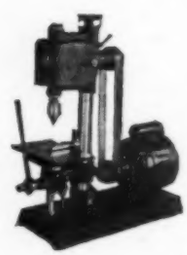
Sensitive

TAPPING

THE Hamilton Sensitive Tapping Machine is the sensible tool to install for the specialized tapping of tiny holes. It literally feels its way into center position while idling in reverse, and shifts its direction of rotation instantly and automatically when pressure is applied to the feeding lever. Release of pressure instantly reverses direction again and the tap is safely and speedily withdrawn. Blind holes may be threaded to the very bottom without danger of tap breakage.



Within its capacity (0 to 10-32 hole diameter) this machine will take all of the abuse that intensive production can inflict . . . and your work will still be accurate!

Write for illustrated literature containing specifications and prices. Do it now! You'll be glad you did. Address Department D.

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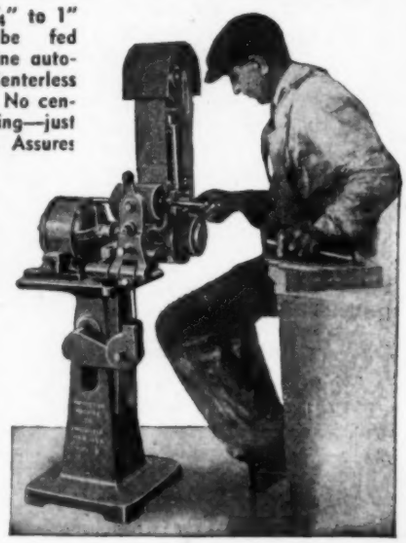

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Production
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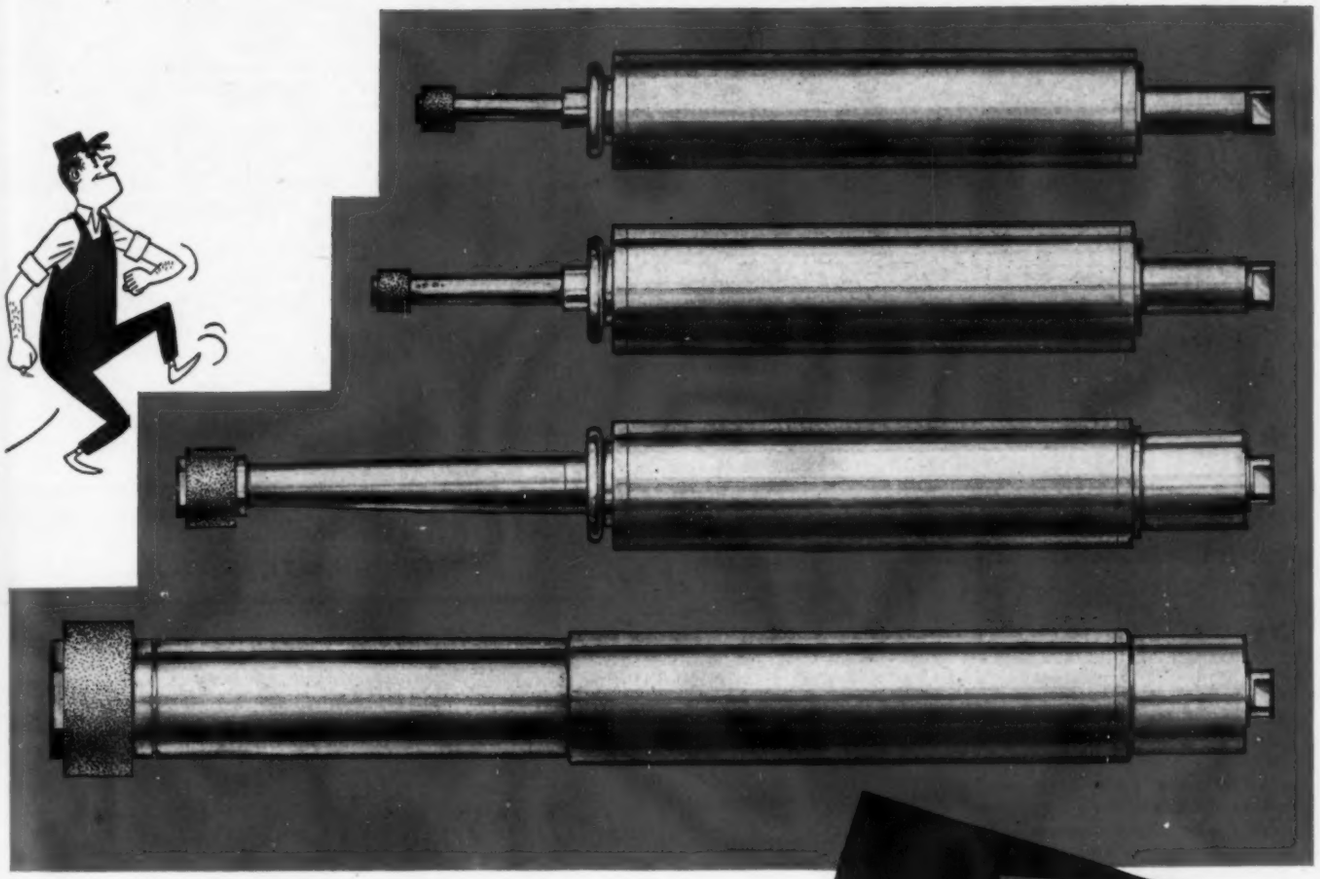
Step Up ***Production of Accurate Sized, Smooth Finished Holes***

with POPE Sealed Lubrication INTERNAL GRINDING SPINDLES



Pope Precision Internal Grinding Spindles come in the sizes, shaft extensions and speeds (up to 35,000 RPM) to meet your every need. The four, illustrated, all fit the same machine without changing motor pulley size.

NEW,
JUST OFF THE PRESS!
This new and complete Ready Reference Catalog No. 56 contains all the information you need to select the best Internal Grinder Spindle for your job.
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No. 40

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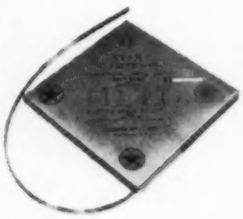
BAND SAWS
(Metal Cutting, including Skip-tooth)



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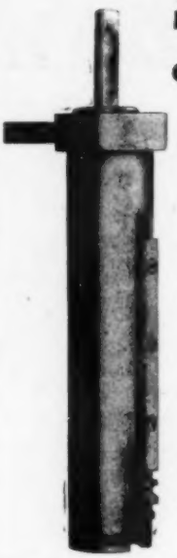
NATIONAL KEYSEATING MILLER

. . . the tool that converts drilling machines into key-seaters and saves time and money



• With this modern tool you can handle keyseating jobs not suitable for keyseating machines on any of your drill presses or radials. Keyseats with parallel sides, accurate in depth and in perfect alignment with bore axis are assured.

The National Keyseating Miller mills, keyseats in one cut. It can be used on offset holes and blind holes. Work clamping is unnecessary. We also manufacture oil-grooving millers.

Made in twenty-seven different diameters from 1/2" to 3 1/2". Several widths of cutters can be used in each size.

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Better Service
Continual Cost Reduction

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Better Service to you, because large stocks of Scully-Jones Arbors are maintained from which your requirements can be filled immediately.

Continual Cost Reduction is accomplished by Scully-Jones Individual Arbor Set-Ups.

Standard Arbors for all machines having N. M. T. B. Tapers. See Pages 112 and 114, Scully-Jones Catalog No. 500, for Style A and B Arbors. Send drawings or specifications for prompt quotations on special arbors.

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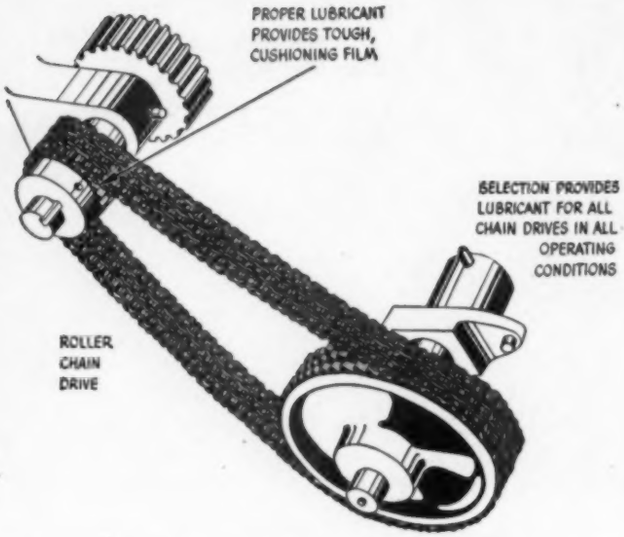
STANDARD ENGINEERS NOTEBOOK

CALOL RPM


PROPER LUBRICANT PROVIDES TOUGH, CUSHIONING FILM
SELECTION PROVIDES LUBRICANT FOR ALL CHAIN DRIVES IN ALL OPERATING CONDITIONS
ROLLER CHAIN DRIVE

Correct lubricant reduces chain drive wear

Selection of the proper Calol lubricant for any type chain drive will materially reduce wear even under the most adverse conditions.

On a worm or exposed roller and block chain, Calol Pinion Grease—0 is recommended for high operating temperature, Calol Roller Oil—X for medium and Calol Journal Oil—135 for low. For enclosed roller or block chains, use Calol Journal Oil—165, —135 and —35 respectively.

For chains exposed to pitch, resinous materials, etc., special Calol Drier Chain Oil is recommended.

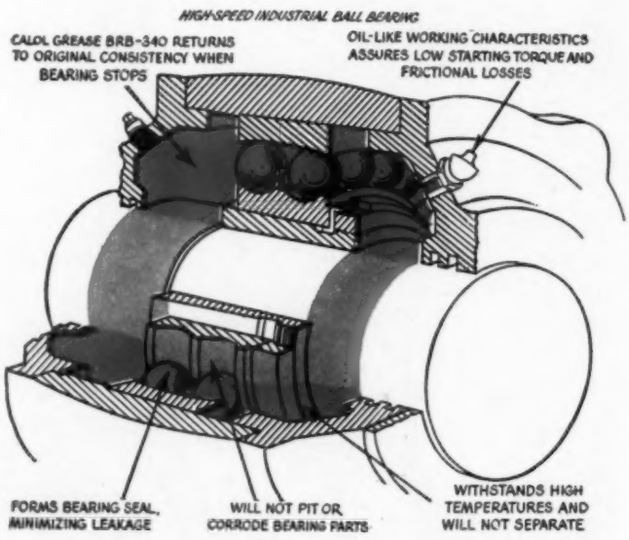
Recommendations for silent chain drives are as follows: Worn, exposed chains: Calol Roller Oil—X, high temperature; Calol Journal Oil—135, medium temperature; Calol Journal Oil—35, low temperature. New, exposed chains or oil-bath-lubricated encased chains: Calol Journal Oil—135, —35 and —25. Splash-lubricated, encased chains: Calol Journal Oil—35, —25 and —14.

New Calol Grease softens and resets

Where anti-friction bearings operate in severe conditions of temperature and speed, newly developed Calol Grease BRB-340 allows easy starting and reduces running friction to a minimum. At high shear rates, its apparent viscosity approaches that of its oil component. However, undue leakage from bearings is prevented by the peculiar ability of Calol Grease BRB-340 to reset, which causes the excess grease, swept aside by balls and rollers, to form a partial seal.

Calol Grease BRB-340 is soft, smooth and has a fine fibrous texture. It is milled by a special process that eliminates bleeding although it contains an unusual amount of oil stock.

When undergoing severe tests, Calol Grease BRB-340 showed no separation in a bearing operating 10,000 RPM at 200° F. for 528 hours. At the end of the test the bearing was in good condition.


HIGH-SPEED INDUSTRIAL BALL BEARING
CALOL GREASE BRB-340 RETURNS TO ORIGINAL CONSISTENCY WHEN BEARING STOPS
OIL-LIKE WORKING CHARACTERISTICS ASSURES LOW STARTING TORQUE AND FRICTIONAL LOSSES
FORMS BEARING SEAL, MINIMIZING LEAKAGE
WILL NOT PIT OR CORRODE BEARING PARTS
WITHSTANDS HIGH TEMPERATURES AND WILL NOT SEPARATE

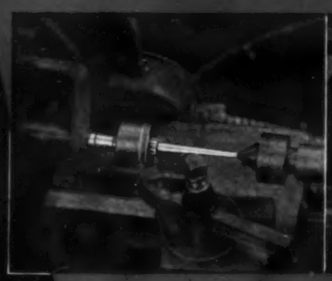
For additional information and the name of your nearest Distributor, write Standard of California, 225 Bush Street, San Francisco 20, Calif.; The California Oil Company, 30 Rockefeller Plaza, New York 20, N. Y.; The California Company, 17th and Stout Streets, Denver 1, Colo.; Standard Oil Company of Texas, El Paso, Texas.

FOR EVERY NEED A STANDARD OF CALIFORNIA JOB-PROVED PRODUCT

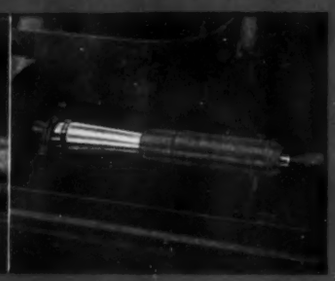
"KNOCK-OUT" EXPANDING MANDRELS

Fast — Positive — Accurate . . . Save machine time, reduce operator fatigue, eliminate special mandrels. Ideal for all turning and grinding operations. Sizes to handle from 3/8" hole to 5 1/2" hole.

Production turning 45° on 11 lb. casting held on M46 Expanding Mandrel.



Turning small piece in tool room. I. D. 15/32" held on MO Expanding Mandrel.



Production grinding 45° angle holding .001" concentricity. Using M3 Expanding Mandrel.

"KNOCK-OUT" CHUCKS

The tougher the job the tighter it grabs the tool. This self activating chuck eliminates slipping . . . marred and bent shanks. Yet it can *always* be loosened by hand. Saves Time —Reduces Tool Costs.

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Thor 000 Air Grinder
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PNEUMATIC GRINDERS AND SANDERS

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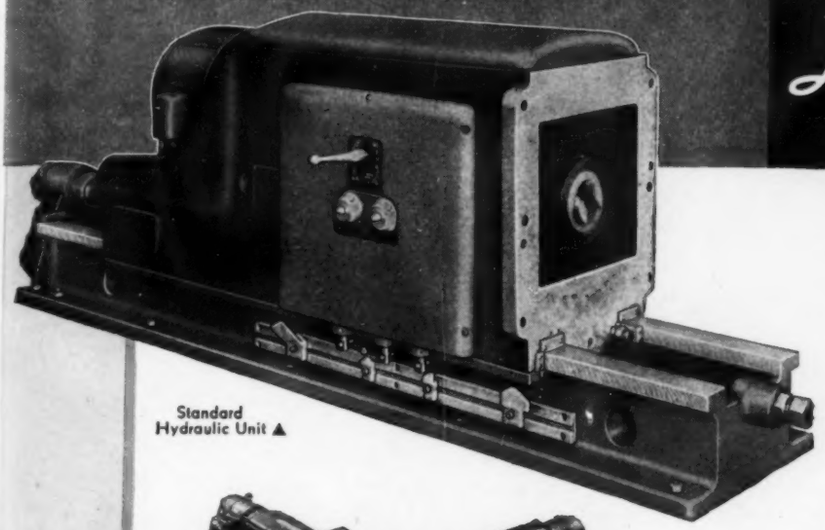
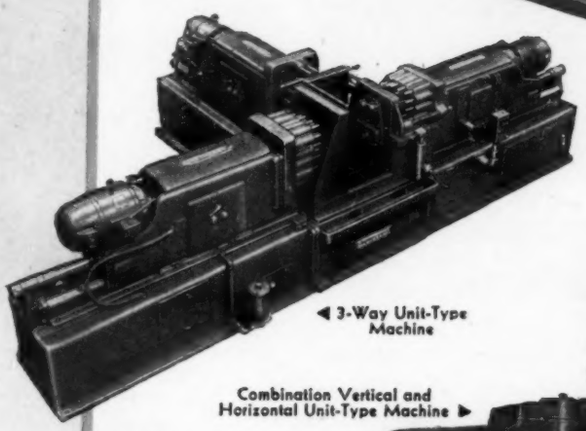
CONTROLLED PRODUCTION with BARNESDRIL Hydraulic Units

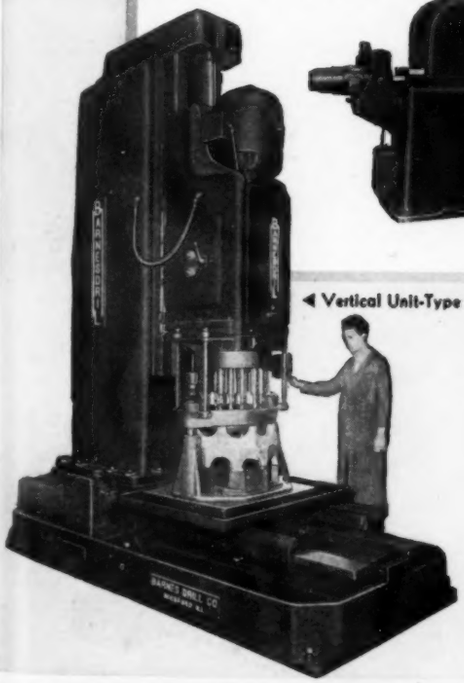


Standard Hydraulic Unit ▲



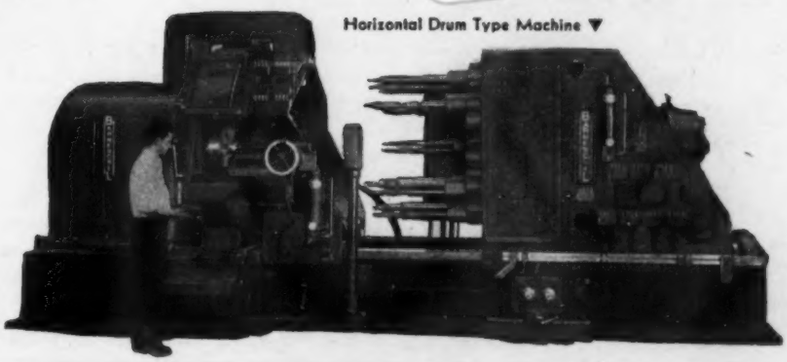
◀ 3-Way Unit-Type Machine

Combination Vertical and Horizontal Unit-Type Machine ▶



◀ Vertical Unit-Type Machine

Horizontal Drum Type Machine ▼



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Faster handling and processing of work pieces — Drilling, Reaming, Facing, Boring and Tapping Operations — is provided by BARNESDRIL Hydraulic Units through semi- or fully-automatic cycle arrangements, multiple spindle heads, and progressive work stations. Engineered set-ups require only loading and unloading by the operator.

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High speed operation is accomplished through hydraulic operation, infinite feeds, and a variety of spindle speeds to suit specific production requirements and the number of operations to be performed. Production is continuous even during loading and unloading.

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Through flexibility provided by interchangeable spindle heads and ease of machine set-up, these standard units offer production methods which are easily converted from one job to another. Use of single units or various angular, vertical and horizontal combinations, result in maximum production and minimum investment in equipment.

New HIGH PRODUCTION METHODS — Send for complete information on typical field applications of Hydraulic Units. Ask for Bulletins B-1504 and B-34.

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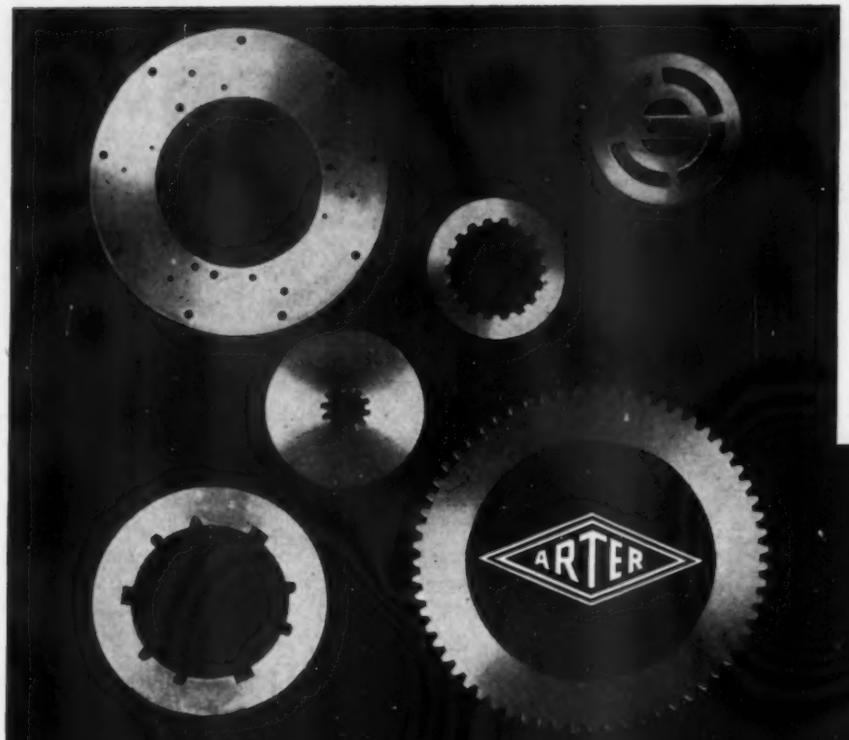
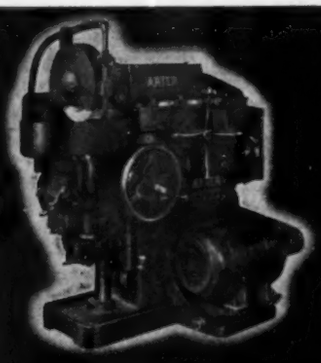


The wide range of circular cutters, single or double bevel cutting edges, are ground to exacting requirements for parallelism, finish and thickness by

ARTER

Rotary Surface Grinders

These requirements are readily obtained by these versatile grinders.



ARTER GRINDING MACHINE COMPANY

WORCESTER, MASSACHUSETTS • U. S. A.

A NEW 20" DRILL

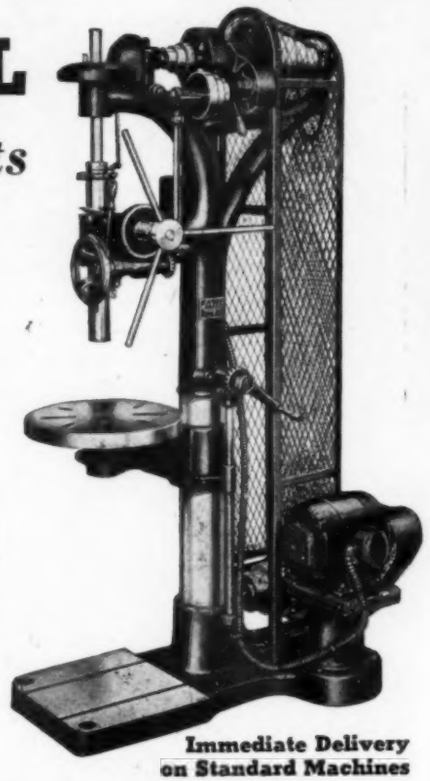
To Meet Your Requirements

FOR ACCURACY Ruggedly designed for modern production. All parts tooled for interchangeability—Spindle is forged steel and quill has bronze oil-groove bushings—Morse taper as well as table arm is bored in spindle after assembly—table surface held at right angle to spindle to .007 in 6 inches.

FOR SPEED Convenient controls with long wearing designed mechanism speeds up operator handling—reduces fatigue and chance for spoilage. Table rotates on arm, and both swing on machined column for working space on base. Automatic feed trip operates through full spindle travel.

FOR CAPACITY Power is delivered smoothly to give the Sibley 20" a capacity of 1¼" in cast iron or equivalent in other metals. Drive gears of 1:2 and large back gears of 1:4 ratios deliver ample power for every load—Castings are high-tensile, semi-steel. Motor drive is cast integral with the machine base.

SIBLEY MACHINE & FOUNDRY CORP., 30 East Tutt Street, South Bend 23, Indiana



Immediate Delivery on Standard Machines

SIBLEY A REPUTABLE NAME IN DRILLING MACHINES

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Efficient PLANT... *Experienced* PLANNING!

Since the days of 1850 when fine carriages and wagons were produced with the help of Defiance-built precision machines for wood-turning . . . *accuracy* has been the watchword at Defiance!

Today—planning, plant and production at Defiance are geared to achieve the utmost *accuracy* and *efficiency* in Defiance machines for the Age of Metal. These include the finest heavy machines for boring, milling, drilling and tapping. Engineered with the experience of 97 years . . . built to help you *produce more,* with *greater precision* and *lower costs.* Defiance Machine Works, Inc., Defiance, Ohio.

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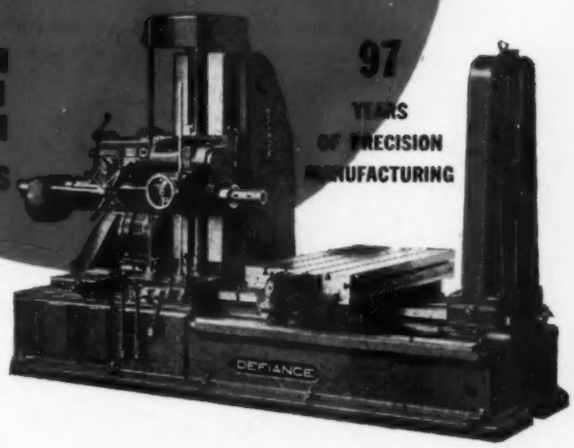
BORING . . . MILLING . . . DRILLING . . . TAPPING MACHINES

97 YEARS OF PRECISION MANUFACTURING



Defiance No. 25A Horizontal Boring Machine is designed with outboard bearing supports allowing maximum cross travel without sag. It has a 3¾" bar . . . 20 speeds range from 12 R.P.M. to 1000 R.P.M. . . . 30" x 60" table. Oversize construction insures rigidity.

HP Type Horizontal Broaching Machine.
50-ton capacity, 76 inch stroke.

THE GOVERNMENT AGREES . . .

. . . that broaching has given many branches of industry the two most desired assets of modern manufacturing. Employing the broaching process to marked advantage in federal munition plants throughout the war, the government can speak with authority on its value. Offering some of these surplus machines for sale, the War Assets Administration cites the economy, speed and precision with which broaching can supplant the machining of parts by conventional methods.

Let Lapointe re-tool these used machines to give you more adequate service. Veterans with valuable war service, these machines have a place in our peace time economy. Rehabilitation can restore their best performance, and give the maximum utility inherent in the long-life characteristics of Lapointe machines.

For full machining efficiency in your long term plans, Lapointe offers a complete line of *new* machines incorporating the latest advances in the art of broaching for innumerable products ranging from large automotive cylinder blocks to tiny watch gear cases. We can offer prompt delivery on all standard machines.

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To learn specifically what broaching can do for you, write today to Dept. F, The Lapointe Machine Tool Company, for your copy of our "Instruction Manual", covering this economical, high-speed process.

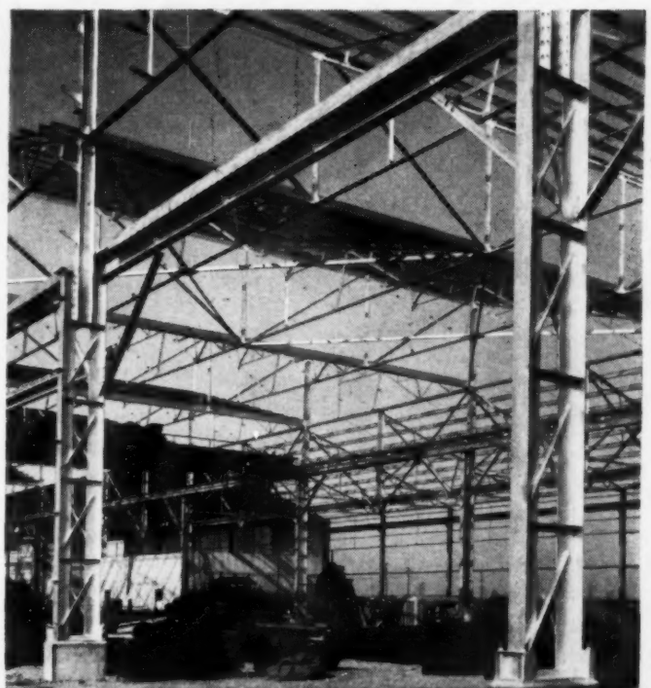
THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHES AND BROACHING MACHINES

Union Steel · Daco Development

Both use SMITHway *Certified* Electrodes

UNION STEEL COMPANY, Los Angeles, adds to the increasing industrial strength of the West Coast with a new all-welded building 1,250′ x 80′. Of A. S. T. M.-A-7 structural steel, it was welded throughout with SMITHway Electrodes SW-15 and 35. For construction, as well as production, SMITHway Electrodes take the risks out of welding.

DACO DEVELOPMENT CO., Oakland, Calif., another growing West Coast industry, uses SMITHway Certified Electrodes (SW-11) in the assembly-line welding of Linco Level Load trailer axles. For *all* kinds of jobs in *all* kinds of plants and shops, the A. O. Smith program of continuous welding research makes welding the modern industrial tool.



New, all-welded Union Steel building, Los Angeles

Welding Linco Level Load trailer axles, Oakland

SMITHway *Certified* Welding Electrodes—Made *by* Welders...*for* Welders

Through Leading Distributors Everywhere

SMITHway A. C. WELDERS

A complete line, for all kinds of jobs. Six models, rated at 150, 200, 250, 300, 400 and 500 amperes. Write for complete specifications and prices.

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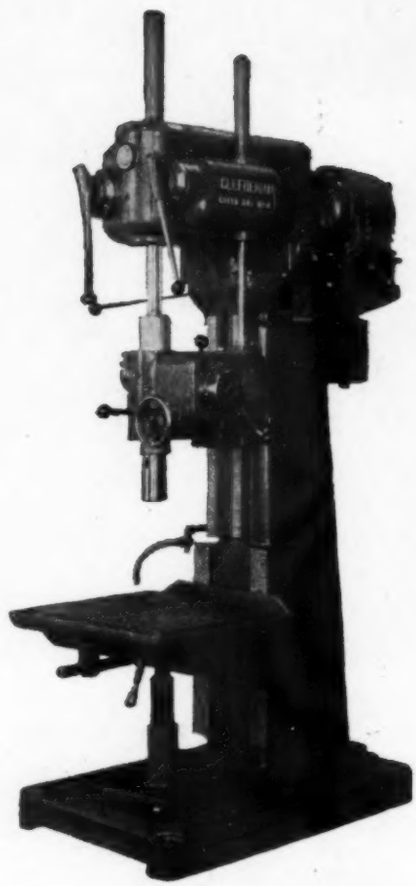
a general purpose machine with the production capacity of a single purpose machine

it's the CLEEREMAN *Sliding Head* DRILLING MACHINE



Yes, the Cleereman Drilling Machine has proved itself economically adaptable to single-piece jobs and to the severe requirements of the production department. It's a machine that produces accurate holes at high speed and at low cost. It is simple to operate and has a wide selection of speeds and feeds.

Write today for descriptive literature giving full details on both Round and Box Column Cleereman Drilling Machines.

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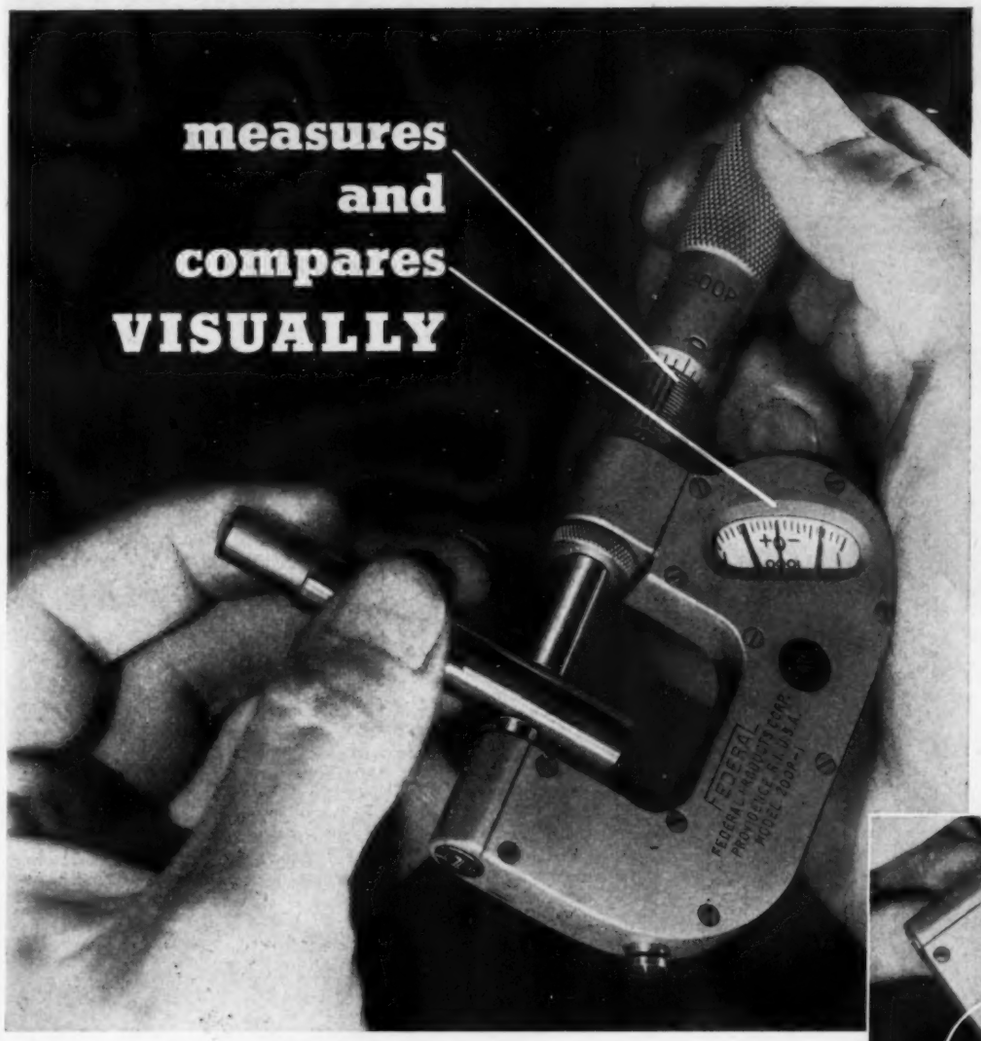
CLEEREMAN MACHINE TOOL CO. Green Bay, Wis.
BUILDERS OF PRECISION JIG BORERS & DRILLING MACHINES

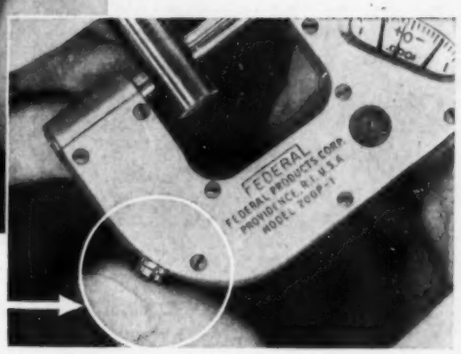


without errors of "feel"

With this Indicating Micrometer, you *see* rather than *feel for* the dimension. You know when you're right . . . In a top quality micrometer you have a Dial Indicator which *shows* the precise measurement in tenths (.0001"). This eliminates the human variations in setting the spindle at its required uniform pressure.

You get four additional positive advantages. First, by retracting the lower anvil with the push button, you have a snap gage to use on job lots. Second, the tolerance hands on the dial make it easier to determine the dimensions which are within tolerance. (This is a natural for Statistical Quality Control.) Third, you get Tungsten Carbide Anvils. Fourth, all except the spindle is finished in beautiful, rust-proof dull chrome.

The Federal Indicating Micrometer is a basic instrument you need today. We invite you to write for a descriptive folder.



Retracting this button enables you to use the Indicating Micrometer as a snap gage on job lots

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CUTTING ANGLE
NOT CHANGED
BY RESHARPENING

THAT'S ONLY *ONE REASON* WHY
BOKUM SINGLE POINT TOOLS
WIN FAVOR

The form never changes—regardless of how often Bokum Tools are resharpened. The angle remains constant—due to the helical backed-off form of the front of tool. Clearances can never be ground away. That means long life and economy.

This unique design characterizes the tool for general boring (Style A), the tool for facing and bottoming (Style B) and the tool for internal threading (Style C).

Ask for catalog K-1139 for High Speed Steels
—Catalog K-398 for Carbide Tipped.

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Making Die Head History

When H & G goes to work for you

YOU will always remember the day you change to H & G Insert Chaser Die Heads. Your threaded parts production picture undergoes a complete transformation. As you walk by the machines you will see

— IDLE men at BUSY automatics.

— NOT BUSY men at IDLE automatics.

The former spells PRODUCTION . . . PROFIT; the latter spells NON-PRODUCTION . . . LOSS.

Based on a recent impartial survey, screw machine experts voted H & G Insert Chaser Die Heads their *number one choice.*

A DAYTON man gives this reason: *"Holds size better. Threads straight and true."* A NEW HAVEN man says: *"Accuracy, performance, economy."* A man in HARTFORD writes, *"More threads per grind."* From CINCINNATI comes this: *"For close to shoulder threading."* From SAN DIEGO a leading screw machine parts producer writes: *"Interchangeability of chasers for different styles of die heads."* A manufacturer in WORCESTER says: *"Low price chasers . . . Quick to set. Uniform high quality threads."*

Simple
Strong
Accurate

Sizes and Styles for all machines on which threads are cut

H&G Insert Chaser DIE HEADS
LITERATURE ON REQUEST

THE EASTERN MACHINE SCREW CORPORATION
Manufacturers of H & G DIE HEADS · THREADED RODS · SCREW MACHINE PRODUCTS
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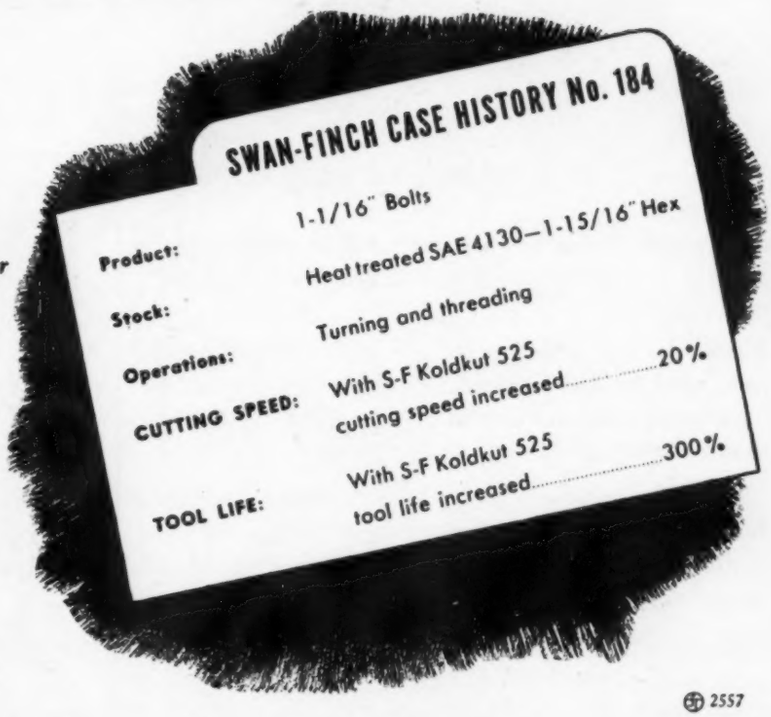
tool life tripled

WITH SWAN-FINCH CUTTING OIL KOLDKUT 525

When you use a cutting oil suggested by a Swan-Finch man, the usual result is improved product at lower cost. The reason: the Swan-Finch man's experience—*a human factor no catalog can offer.* He fits cutting oil to machine operation . . . suggests the *best* oil to make such BIG improvements possible.

A Swan-Finch man is backed by his company's 90 years' experience in the lubrication field. Take advantage of his know-how—his background. Without cost or obligation, the Swan-Finch man will suggest *the best cutting oils for you . . . and with no interruption of your production.*


SWAN-FINCH CASE HISTORY No. 184
Product: 1-1/16" Bolts
Stock: Heat treated SAE 4130—1-15/16" Hex
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Yes, we'd like to see what a Swan-Finch engineer can do for us. Please have him call.

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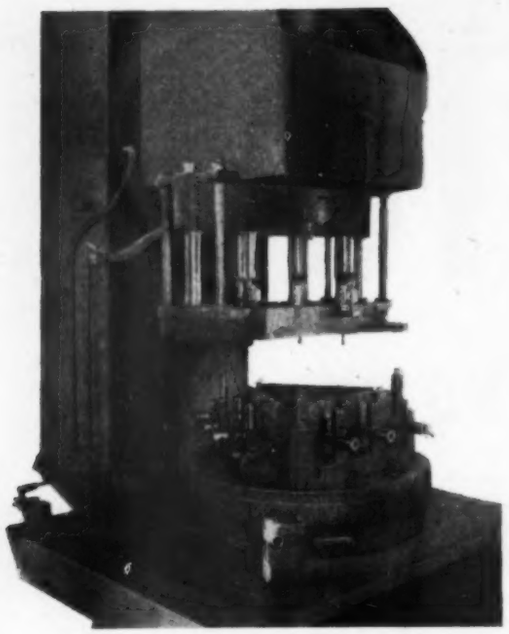
Production Up
QUALITY IMPROVED



Profits are higher when production is stepped up in quality . . . Buhr retooling this standard drill press consists of

4-Spindle ball bearing induction hardened shaved gear drill head. Vertical adjustment in spindles for tool wear and oil pump for positive lubrication. Head mounts on special motor bracket.

Bushing plate with renewable bushings. 3-Station holding fixture clamps two work pieces in each station and is mounted on a 36" index table with 3 indexing stations.

Electrical safety devices are incorporated to insure correct positioning before cycling of machine Drills (2) 1" diameter holes in 1st station and hollow mills (2) 1.393 diameter bosses in a steering gear housing. Production of 150 pieces per hour at 80% efficiency.

Buhr Engineers are available to help you solve your production problems.

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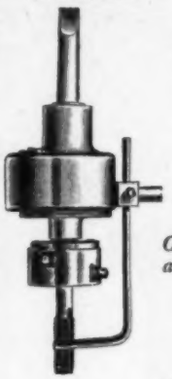
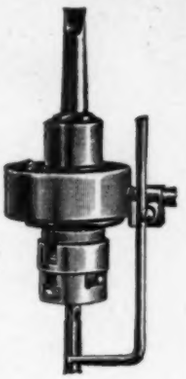
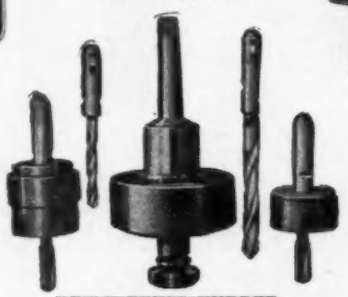


Size	Taps Exact Size
No. 00 H.S.	Up to 1/4"
" 00	1/8" 5/16"
" 0	3/16" 1/2"
" 1	1/8" 3/4"
" 2	3/8" 1 "
" 3	5/8" 1 1/4"
" 4	3/4" 1 1/2"
" 5	3/4" 2 "



Our High Speed Tappers are Super-Sensitive for Small Tapping

Style B Positive Stop Holds Work Down

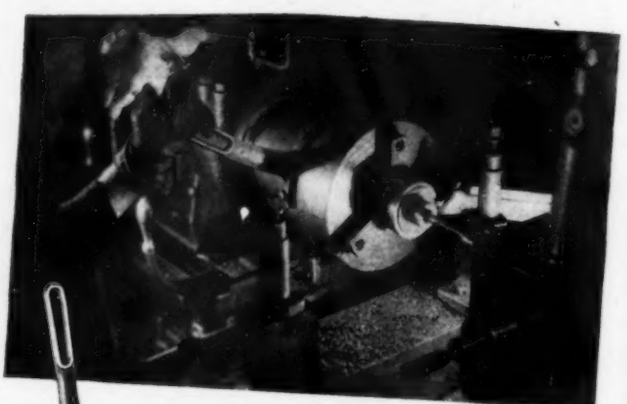


Style C Graduated Adjustable Safety Friction

DRILL PRESS TURRET

Style D-E with Quick-Change Tool Holders to Drill, Tap and Set studs, etc., without moving work, or stopping or reversing machine. Individual friction adjustment in each tapholder. If required.

Also, Opening Die-Heads; Opening Stud-Setters; Friction Screw-Drivers and Nut-Setters, etc.



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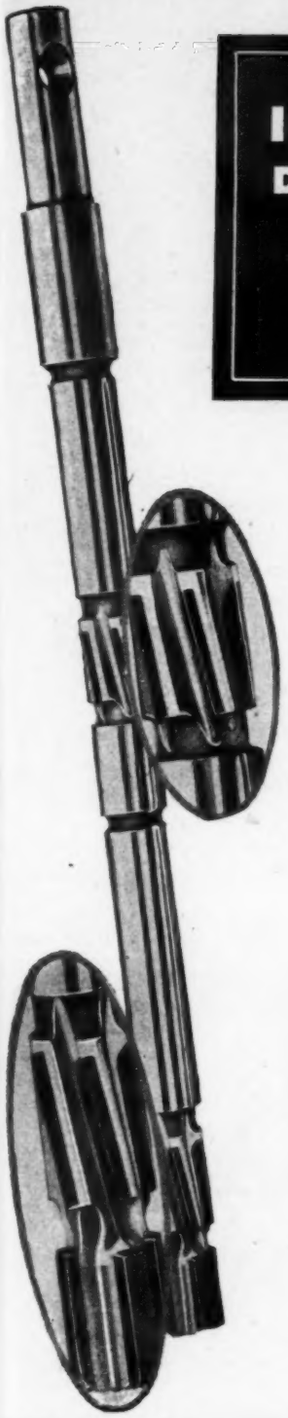

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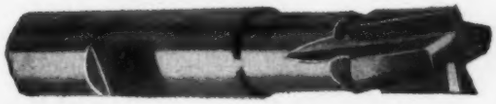

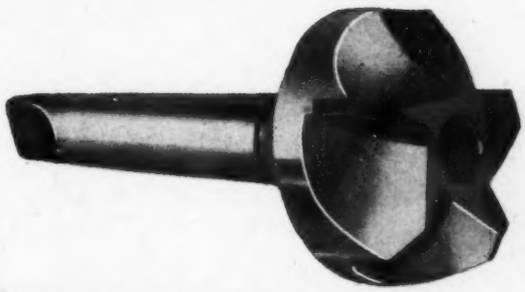

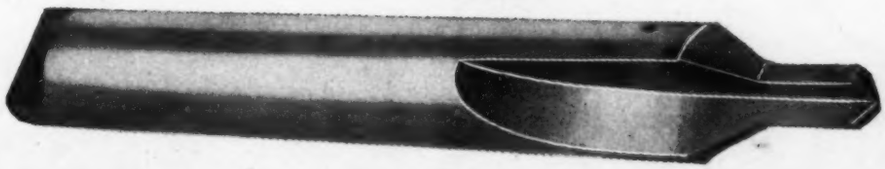

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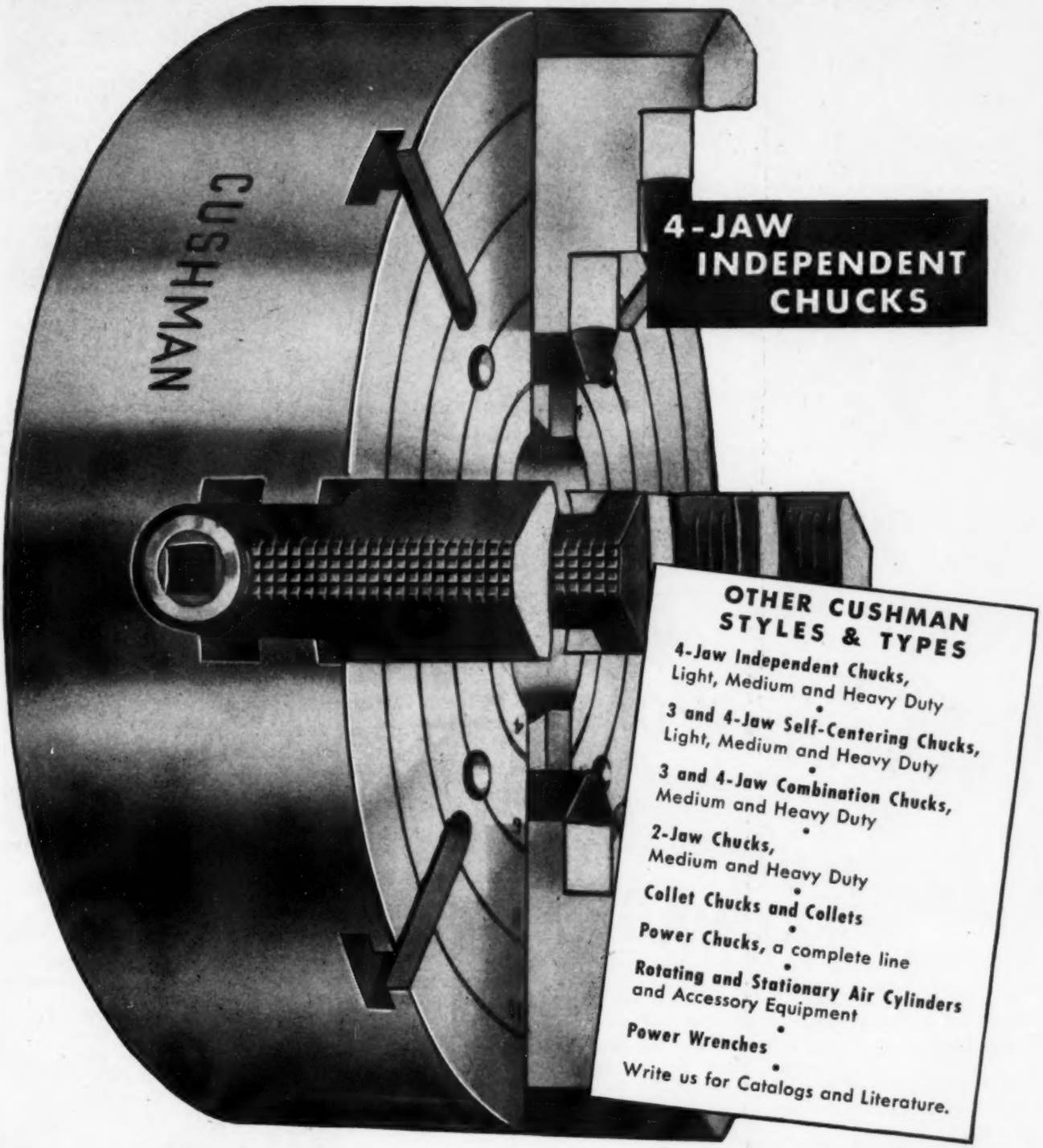

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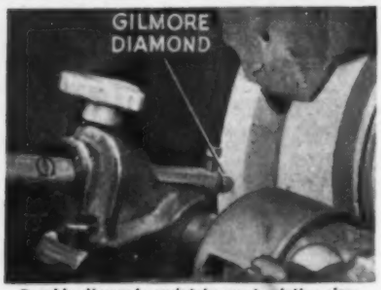

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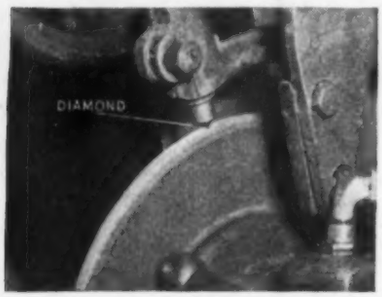

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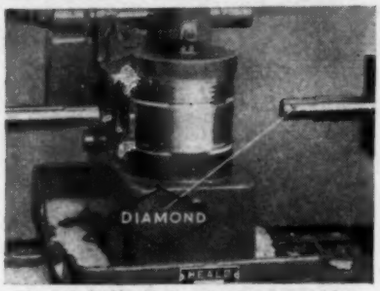
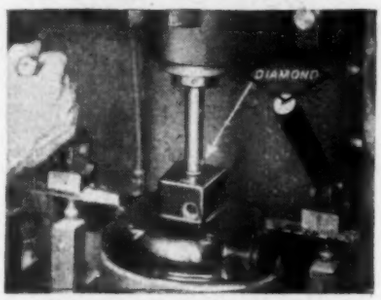


Diamond Boring Tool performing a precision boring operation on wrist pin hole of piston.



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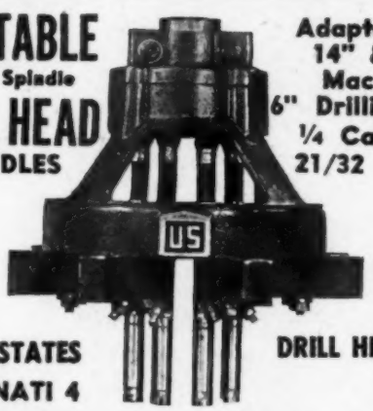

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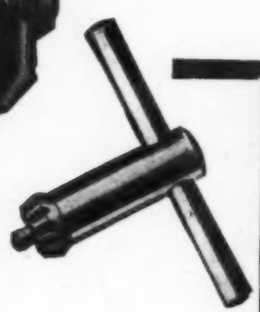

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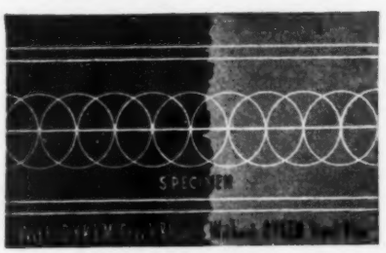

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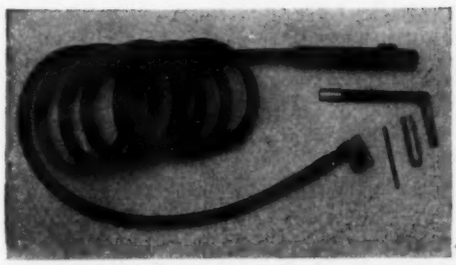

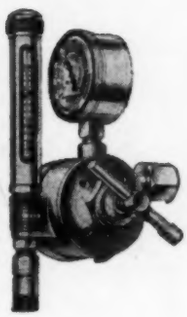

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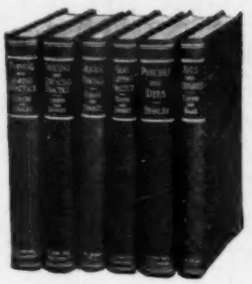

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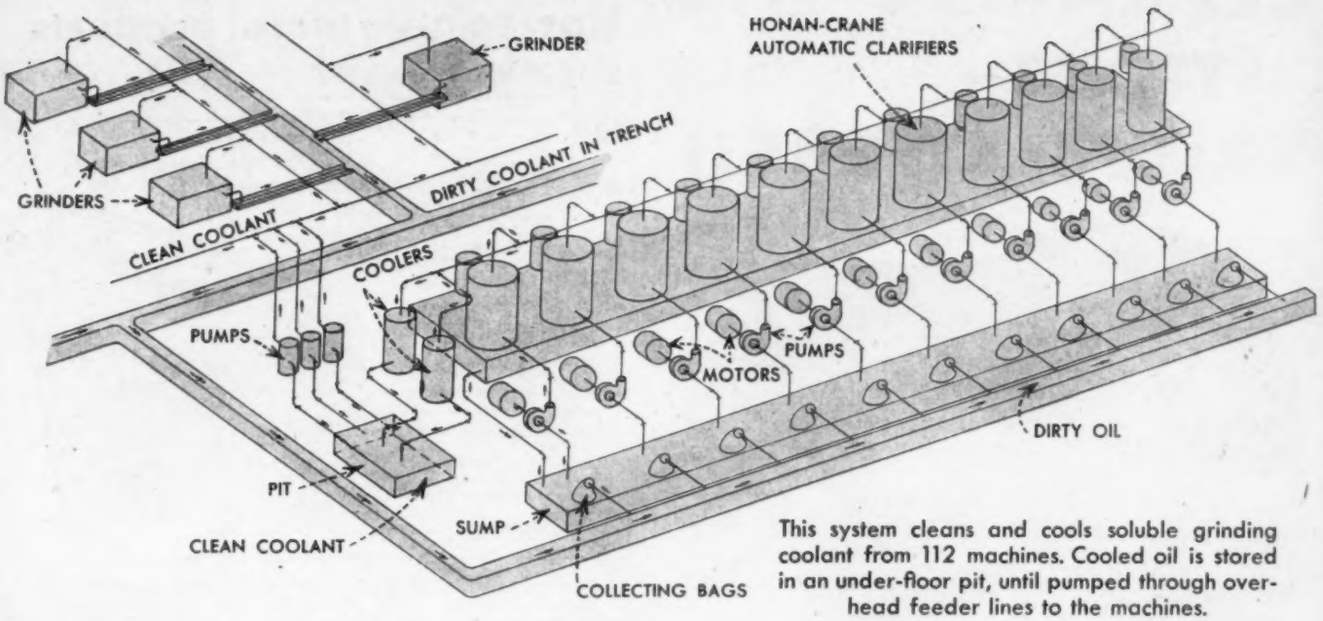

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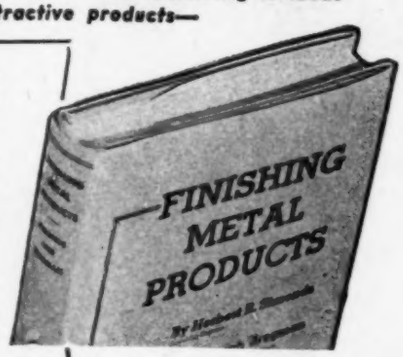

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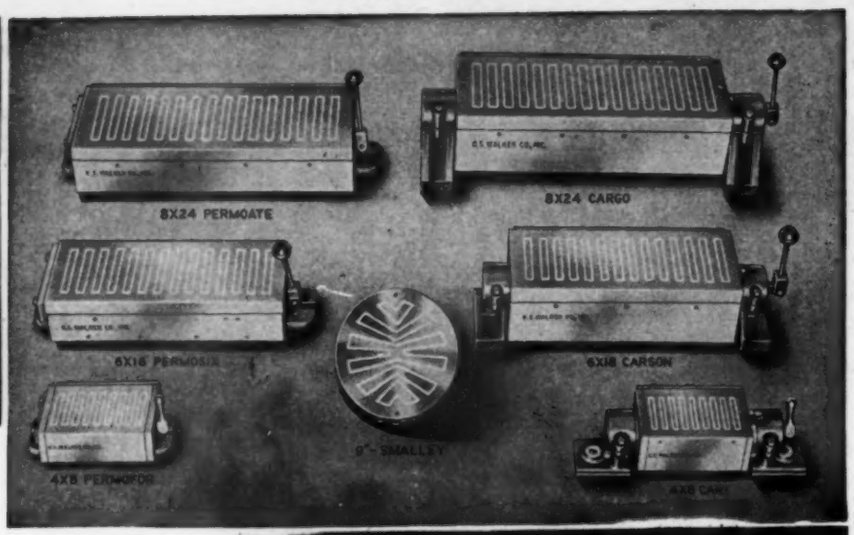

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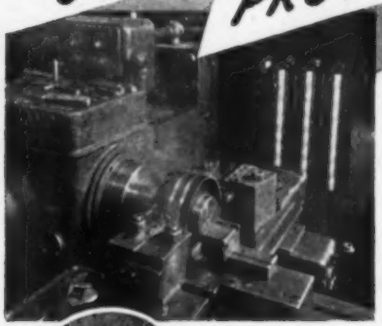

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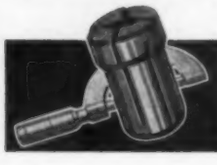

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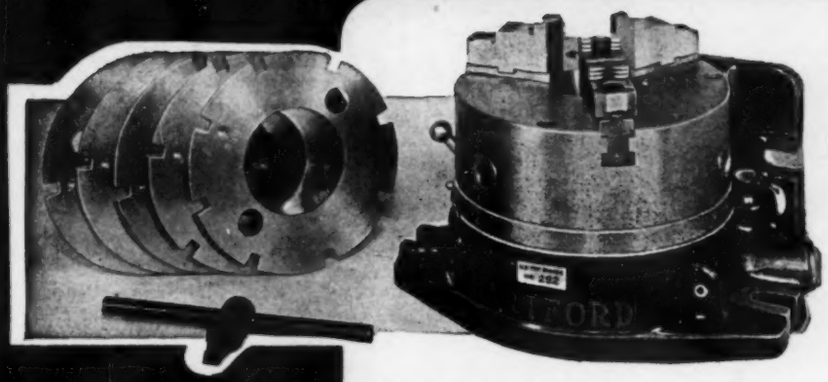

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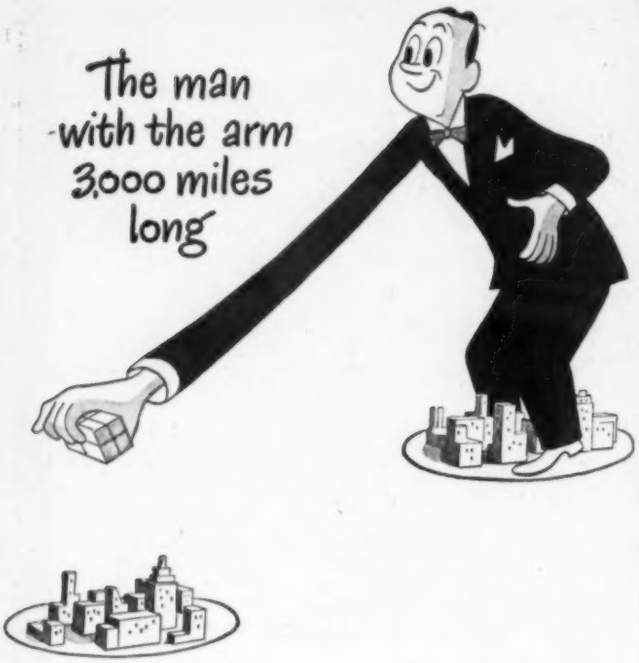

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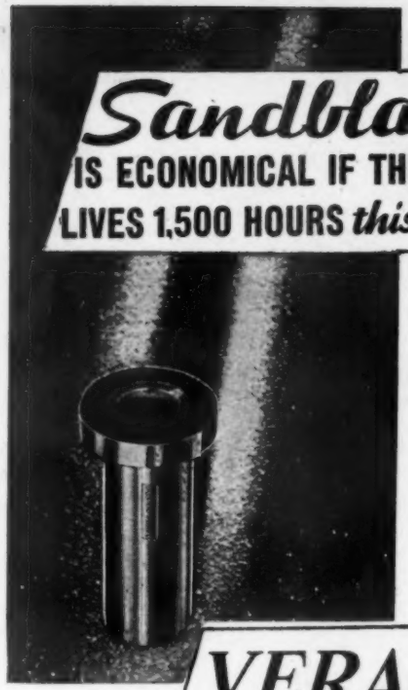

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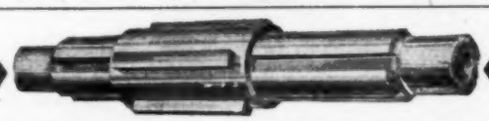

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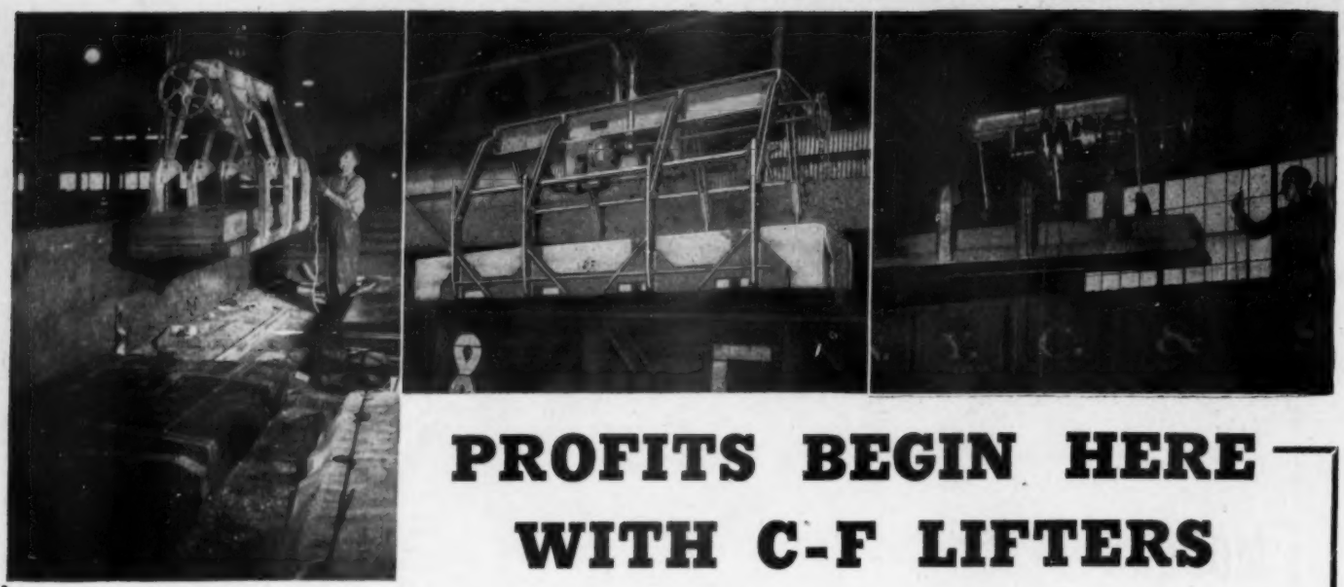

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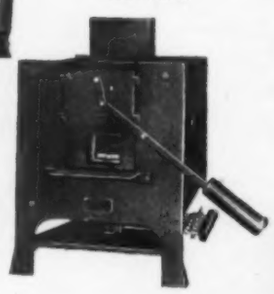

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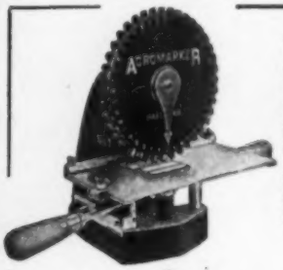

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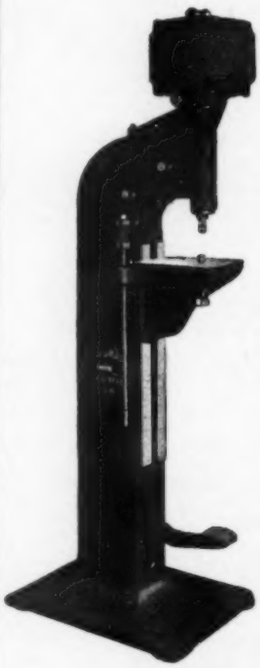

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	YES	NO
1. Is the machine on which you sharpen taps always available—ready to use—*without* the necessity of setting up an attachment, truing it up, etc.?	☐	☐
2. Can you sharpen even the smallest sizes, i.e. No. 0 or No. 1?	☐	☐
3. Is the tap *supported* at the end during sharpening—to eliminate vibration?	☐	☐
4. Are *all* spiral flutes the *same depth* and *length*?	☐	☐
5. Can you maintain *uniform* shape and size of flute?	☐	☐
6. Do you get positive rake the full length of spiral flutes?	☐	☐
7. Can you also grind the full length of the straight flutes?	☐	☐
8. Is your method free from operational and dust hazards?	☐	☐
9. Can you grind wet or dry—as you choose?	☐	☐
10. Can you grind *FAST*—a flute every three or four seconds?	☐	☐

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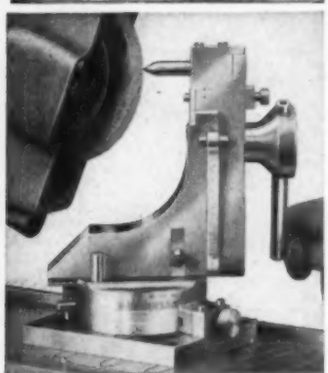

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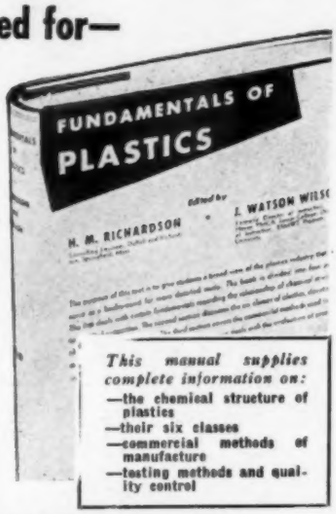

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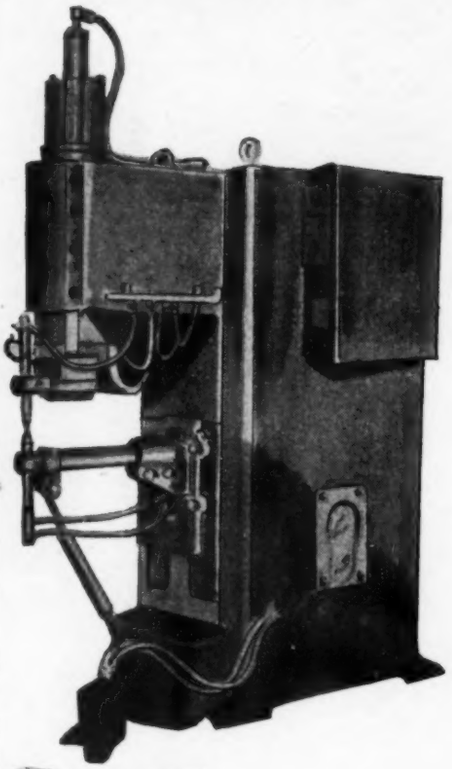

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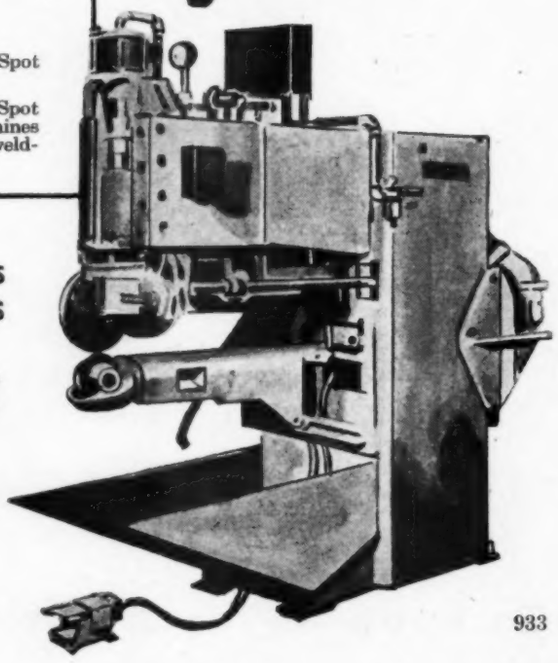

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(Continued from page 329)

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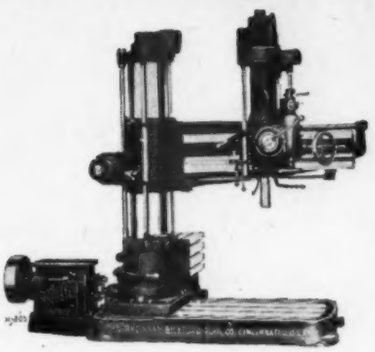

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#70 Heald Internal Grinder
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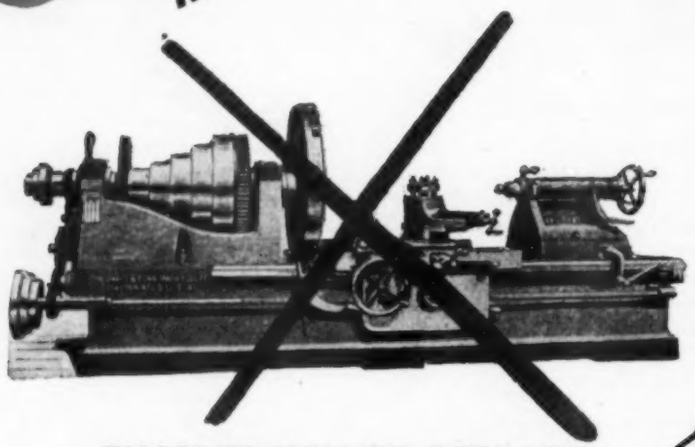

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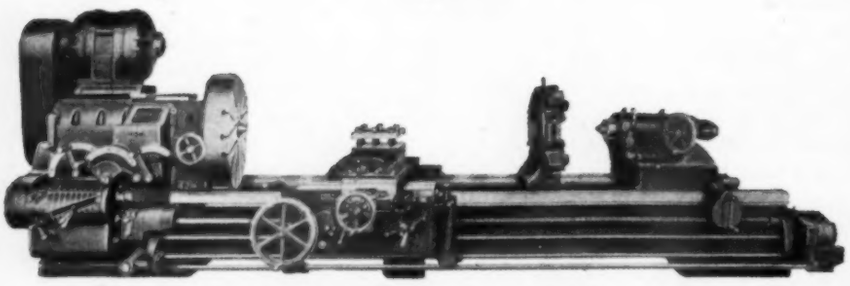

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FRANKLIN 4½" bar, single pulley drive
LANDIS #35—3½" bar—floor type
NILES BEMENT POND 5", 6", 7" bar—floor type
OHIO #5F-420 5" bar, floor type, latest type
P & H #10, 3½" bar, floor type, M.D.

BORING MILLS—Vertical

BETTS 120"—2 swivel heads, motor drive
BETTS (Consolidated) 100"—2 heads, DC, Latest type
BULLARD 24", 36", New Era Type, M.D.
BULLARD 42", Spiral Drive, latest type
BULLARD 86"—2 swivel heads, motor drive
COLBURN 72" 2 swivel heads, AC, M.D.
KING, 30" Vert., M.D.
KING 36" Motor Drive, Latest Type
KING 62" 2 swivel heads, PRT, AC, M.D.
NILES 42"—2 swivel heads; power rapid traverse
NILES 73", 100" 2 swivel heads, PRT, AC, M.D.

DRILLS

BAKER #121 Single spindle—latest type
BARNES #H3, Hydram, latest type
BARNES #210—single spindle—latest
BODINE 42-20, 42-30 automatics—M.D.
COLBURN #14, 2 spindle, heavy duty, AC, M.D.
EDLUND #1B, #2B, #2MS, M.D.
FOOTE BURT SIPP #2, #3—single spindle—latest
HENRY & WRIGHT 2 spindle
PRATT & WHITNEY No. ½Bx30" 2 spindle, Deep Hole latest type

DRILLS—Radial

AMERICAN 3½'9"—Maxi-Speed, Motor Drive
AMERICAN 4'11"—5'11"—5'13" AC, M.D.
AMERICAN 7' Triple-purpose, M.D.
AMERICAN 3'11", hole-wizard, Latest Type
CANEDY OTTO 3'11" New
CARLTON 6'17"—Latest Type
CARLTON 4'13", 5'14", 6'15"—M.D.
CINCINNATI BICKFORD 4'11", 4'13", 6'19"
DRESES 5'13", AC, M.D.
DRESES 5'15", Universal, AC, M.D.
FOSDICK 5'14", AC, M.D.
MUELLER 4½'9", AC, M.D.
NILES BEMENT POND 6'15" uni., AC, M.D.
RYERSON 4'11", AC, M.D.
WESTERN 3', 4'18", 5'18", 6'20", latest type

GEAR CUTTING EQUIPMENT

BARBER COLMAN Type A Hobber—latest
BARBER COLMAN Type S, #3, #12 Hobber, M.D.
BROWN & SHARPE #3H gear cutter, M.D.
FELLOWS #7, #7A type, all models, latest
FELLOWS #6, #6A type, all models, latest
GLEASON 6", 11", 18" bevel gear generator, M.D.
GLEASON—12" bevel gear generator—latest
GLEASON #13 tester, M.D.
GLEASON 15" Quenching Press
GLEASON 24" Bevel Gear Planer
G & E #96H Gear Hobber, with differential
GOULD & EBERHARDT 18H Hobber with in-feed, differential, M.D.
HERCULES 24" HOBBER, differential, M.D.
PRATT & WHITNEY 10" Grinder, hyd.—latest type

DEPENDABLE MACHINE TOOLS • PROMPT SERVICE

ALL BUILT SINCE 1941

GRINDERS—Cyl.—Plain & Uni.

BROWN & SHARPE #1, #2, #3, #4 Univ., motor drive—latest type
BROWN & SHARPE #5 Plain 3x12, 3x18 LATEST
LANDIS 6x18, 6x20, plain, M.D.
LANDIS 10x24—Universal—Type "C"—Hyd.—Latest
NORTON 10x18 Plain—motor drive
NORTON 10x36" Plain Type C, Hyd., latest type
NORTON 16x72 Plain, Type C—latest type
NORTON 16x72 Universal, HYD., Multi-purpose, Latest Type
NORTON 24x240" Plain, M.D. Type A

GRINDERS, Internal, Cutter and MISCELLANEOUS

BROWN & SHARPE #10 Tool & Cutter—latest
BRYANT No. 16—16" Chucking—Internal—latest
BRYANT #5 Internal, hyd., latest type
CINCINNATI #2, #3, #4 centerless, LATEST TYPE
FITCHBURG Uni., spline shaft, hyd.
GLEASON #12 cutter grinder
HEALD 72A3 Plain internal, latest type
HEALD 72A3 Sizematic internal, latest type
HEALD 72A5 plain internal, latest type
LeBLOND #2 uni., tool and cutter, latest type
OLIVER Tool and Cutter, Latest Type
PRATT & WHITNEY Contour Cutter—latest type
SELLERS #1 Tool—Motor Drive
SELLERS #2 Tool—Motor Drive
SELLERS #4T Uni., Tool—latest type

GRINDERS—Surface

ARTER 30" Rotary Surface—Hydraulic—latest type
ARTER Automatic Piston Ring
BLANCHARD #16A—Dial Type—motor drive
BLANCHARD #16, 26" Chuck, Motor Drive
BLANCHARD #18-30" chuck—latest
BLANCHARD #27—42" Chuck—Latest
BROWN & SHARPE #2 M.D., Latest Type
HILL ACME—24x30x72, Hyd., Latest Type
MATTISON 12x16x48 Hyd., Latest Type
MATTISON 14x16x36 Hyd., Latest Type
MATTISON 14x16x60 Hyd., Latest Type
NORTON 10x36 Hyd., Latest Type

LATHES—Engine & Mfg.

AMERICAN 36x25' centers—Timken Bearing—2 carriages P.R.T. Taper Attachment—Latest Type
AMERICAN 42x25' bed geared, M.D.
BRIDGEFORD 36"x28', 36"x32' bed—2 carriages, M.D.
HARDINGE TR59, Motor Drive., Latest Type
HARDINGE 9x54" bed, QCG, Cataract
HENDEY 14"x8' bed geared head
HENDEY 22"x8' bed, geared head
HENDEY—12x54 centers—Mfg.—latest type
HOUSTON, STANWOOD & GAMBLE 42x25' bed
LeBLOND 13"x4' bed, Timken Mfg.—latest
LOSWING 4x60", 4x84", 8x60", 8x84", Timken Bearing, Latest Type
LOSWING 5x34" Model LR Auto. Timken latest
MONARCH 22x48" Centers, Timken, latest
NILES 42"x60", double head, Motor Drive
NILES 48x10' centers—heavy duty—Timken Bearing P.R.T.—Latest Type
NILES 60x10' centers—heavy duty—Timken Bearing P.R.T.—Latest Type
NILES 60x15' centers—heavy duty—Timken Bearing P.R.T.—Latest Type
PITTSBURGH 50'x30' bed—M.D.
RIVETT #698—8"x18" Centers

LATHES—Turret

BARDONS & OLIVER #3, #5, #7 Timken Bearing—latest type
CINCINNATI ACME #1, #5W, Timken bearing, latest type
GISHOLT #3D Simplimatic—Timken—latest
GISHOLT #1L, #2L, #3L, Universal, Timken Bearing, Latest Type
GISHOLT #4L, 9" hole—cross sliding turret—Timken Bearing—latest type
JONES & LAMSON #3, #7C Univ., latest type—Timken Bearing
LIBBY #1H-5 Timken Bearing—latest 5½" hole
MOREY 2G, #3, #4, Timken Bearing, latest
WARNER & SWASEY #3, #4, Uni., Timken bearing, latest type
WARNER & SWASEY #2, Timken, latest
WARNER & SWASEY #4A—uni. 8" hole, timken bearing, Latest Type

MILLING MACHINES—Mfg.

BRIGGS Type 2A, production, HYD, latest type
BROWN & SHARPE #000—Timken Bearing, Latest Type
BROWN & SHARPE #12 auto., Timken—latest
CINCINNATI #0-8 Vert.—Pl. Auto.—Timken Bearing—latest type—Rise & Fall
CINCINNATI 48" duplex, automatic, SPD
KEARNEY & TRECKER #1218 Auto.—Timken Bearing—latest type
MOREY #12M 2 spdle, Profiler & Milling Machine
NICHOLS Hand, M.D.—Latest Type
OHIO Auto. 16"x72" table—Timken Bearing

MILLING MACHINES—Plain

BROWN & SHARPE #2 Light Type, Timken, Latest
CINCINNATI #2L—Timken Bearing, Latest Type
CINCINNATI #3 High Speed, Dial Type, Timken Bearing, latest type
CINCINNATI #4 Timken Bearing, M.D.
CINCINNATI #4S, #5, high power, M.D.
KEARNEY & TRECKER #3K—Timken—latest
KEMPSMITH #4 Maximiller—Timken—latest

MILLING MACHINES—Univ.

AMES Bench, Timken Bearing, latest type, M.D.
CINCINNATI #2, Motor Drive.
VAN NORMAN 22L, Timken Bearing, Latest Type
HARDINGE Bench, Timken Bearing, Latest Type

MILLING MACHINES—Vertical

BROWN & SHARPE #5—motor drive
CINCINNATI #2, #4—Dial Type—Timken—latest
CINCINNATI #3, #4 High-powered, Motor Drive
GORTON #9J High Speed, Latest Type
KEARNEY & TRECKER 2H, 2K, 3H, 3K, 4H, 4K, Timken—latest

PLANERS

CINCINNATI 24" Crank—Motor drive
CINCINNATI 48x48x20', 3 heads, AC M.D.
CINCINNATI 36x36x8', 2 heads, AC, M.D.
CHANDLER 36x36x20' 4 heads, AC, M.D.
CRAVEN 144"x96"x30', 4 heads, DC, M.D. Latest Type
DETRICK & HARVEY 48x48x16', 4 heads, Hyd.
DETRICK & HARVEY 48x48x12 Openside, AC, M.D.
HAMILTON 42x42x20', 4 heads, motor drive
LYND FARQUHAR 28" Openside, motor drive
NBP 54x54x12', 2 heads, box table, AC, M.D.
NILES 48x48x12'—Time Saver—3 heads, P.R.T., box table, DC, M.D.—latest type
NILES 48x48x16', 4 heads, AC, M.D.
NILES BEMENT POND 96x80x20' box table, 4 heads, Hyd., PRT—motor drive
OHIO 42x42x20'—2 heads, AC
PATCH 48x48x14', 4 heads, DC, M.D.
POND 48x48x16' 2 heads, AC, M.D.

SAWS

BRIDGEPORT #48W Abrasive
CAMPBELL #213, 40', wet abrasive, latest
ESPEN LUCAS #138—Cold Saw, M.D.
GROB #OS-200 band, latest type
MOTCH MERRYWEATHER #3 Cold Saw—Hyd.—latest type
PEERLESS 14x14 Hack; latest type

SHAPERS

CINCINNATI 28" Travel Head—2 head Type B
COCHRANE BLY Univ. Vert. Shaper-Miller, M.D.
LAMAIRE 18" Vert. Hydraulic—latest type
MOREY 8", 10", 12", 14", Vertical, Latest type
NEWTON 15" vert. slotter, D, M.D.
MILES 18" ver. slotter, DC, M.D.
PRATT & WHITNEY 6", 10" Vertical, Motor Drive

THREAD MILLING MACHINES

HALL—Planetary, M.D.—Latest Type
MOREY SHIELDS 12x120, 12x192—latest type
PRATT & WHITNEY 4½x12, Model "C"—Latest
PRATT & WHITNEY 6x132—Motor Drive
PRATT & WHITNEY 6x20 Model "C"—Latest
SMALLEY General #20 MB, Motor Drive

MISCELLANEOUS

BARNES #420 2-spindle deep hole Drill—Hyd.—Latest Type
BAUSH Radial Tapper—latest
BILLINGS & SPENCER, 200, 400, 800 lbs. board drop hammer, latest type
CASCADE #120 Industrial deep freeze
FERRACUTE No. DG55, Drawing, latest type
GENERAL ELECTRIC 100KW Generator
LANDIS ¾" Bolt Threader—latest
LaPOINTE #3L Broach, horiz. hyd. 15 ton cap.
LeBLOND #2 deep hole borer, latest type
MORTON 60" Combination traveling head planer, milling and drilling motor drive
NILES 30"x50' deep hole borer, Timken—latest
PRATT & WHITNEY 3-B Jig Borer—Latest type
SHUSTER #1 Wire Straightener
TREADWELL 12"—Pipe Threader—Motor Drive
WHITON 8x108 centers duplex centering, M.D.
YATES AMERICAN J-70, Woodworking Lathe, latest
YODER Multiple tube cutting machine—latest

Over 2,000 Machine Tools in Stock. Your Inquiries Are Invited

QUALITY *Machine Tools*

NOW IN STOCK

No. 2 Cincinnati Centerless Grinder, with Filmatic bearing, hydraulic profile truing attachment, through feed work rest, motor driven. New in 1942.

12′ x 3/16″ Bertsch Combination Punch and Shear, with 15″ gap, double geared, motor driven.

AUTOMATICS
5¼″ Cleveland Model A, single spindle.
16″ x 33″ Fay Automatic Lathe.
⅞″ Cleveland Model M, four spindle.

BORING MILL
No. 31 Lucas, motor driven.

DRILLS
★ 4 Ft. American Hole Wizard Radial Drill, motor on arm, new in 1940.
No. D2 Colburn, single spindle.
No. 314 Baker, single spindle.
★ 21″ and 28″ Cincinnati-Bickford Super Service Drill.
42″ Cincinnati Bickford.
Allen Sensitive Drill, four spindle.
★ No. 3 Bausch Multiple, 20 Spindle, No. 2 Morse Taper, Rectang. Head 20″ x 40″.

GEAR CUTTERS
Model A and D Barber-Colman Gear Hobbers.
No. 3 and No. 12 Barber-Coleman Gear Hobbers.
No. 61 Fellows Gear Shaper, m.d.
6″ Gleason Str. Bevel Gear Generator.

GRINDERS
36″ x 168″ Mattison Surface Grinder.
No. 22 Heald Rotary Surface Grinder.
No. 16-26″ Blanchard Surface Grinder.
No. 72A3 Heald Sizematic Int. Grinder.
No. 72A3 Heald Gagematic Int. Grinder.
No. 13 Brown & Sharpe Universal & Tool.
10″ x 24″ Norton Cylindrical Grinder.
★ 14″ x 30″ Landis Type C Hydraulic Universal Grinder, motor driven.
No. 2 & No. 3 Cinci. Centerless Grinder.
No. 35 Excello Thd. Grndr., new in 1943.
No. 5VRO Hammond Buffer.

LATHES, ENGINE
14″ x 6′ Sebastian, motor in base.
16″x6′ Hendey, g.h.
20″ x 12′ Lodge & Shipley, g.h.
48″ x 12′ Lodge & Shipley, C.D.
IMP and LR Lo-Swing, m.d., new in 1940.
15″ x 30″ Lipe Carbo-matic, new in 1943.

LATHES, TURRET
No. 3A Warner & Swasey, g.h.
No. 2A Warner & Swasey, Timken Bearing, new 1942.
No. 1A Warner & Swasey, g.h., new 1943.
No. 1B Foster, g.h.
No. 4 Warner & Swasey, g.h., new in 1942.
No. 5 Warner & Swasey, Universal, g.h., New in 1943.
No. 3 Warner & Swasey, g.h., new in 1943.
No. 1 Bardons & Oliver, c.d.
No. 1 Brown & Sharpe, m.d.
No. 6D Potter & Johnston.

MILLS
No. 81 Lucas Horizontal Bor'g Mill, m.d.
No. 36 VanNorman, Ram Type, m.d.
No. 4A Brown & Sharpe Universal, s.p.d.
No. 3 Cincinnati Universal, s.p.d.
No. 4 Cin. Plain, Rect. Overarm.
No. 2H Milwaukee Plain double overarm, motor in base.
No. 2-MH Cincinnati Plain, m.d.
★ No. 4H Milwaukee, Double Overarm, motor in base, new 1940.
No. 2H Milwaukee Vert., motor in base.
No. 2209 Milwaukee, Table 22″ x 158″.
No. 3-36 Cinci. Hydromatic Duplex, m.d.
No. 6 Whitney Hand Mill.

MISCELLANEOUS
No. 17 Greenerd Arbor Press.
No. 100 Micromatic Hydrohoner.
8″ x 7″ Troy Vertical Steam Engine.

PLANERS AND SHAPERS
16″ Gould & Eberht. Crank Shaper, m.d.
★ 6″ Pratt & Whitney Vertical Shaper.
36″ x 36″ x 12′ Liberty Planer, 2 heads, box table.
42″ x 42″ x 20′ Cin. Planer, D.C. Rev. m.e.

TAPPERS
No. 2BG Garvin.
Leland-Gifford Radial.

(Approved Dealer for War Assets Administration Surplus Machines)

INDIANAPOLIS MACHINERY & SUPPLY CO., INC.

1961 S. Meridian St., Indianapolis 6, Indiana

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MEXICO OFFICE: Avenida Independencia No. 36B, MEXICO, D. F.

PUNCH PRESSES

IMMEDIATE DELIVERY FROM STOCK

No. 4½ BLISS, 80-100 Ton Capacity straight side punch press, late model with scrap cutters, double roll feeds, bolster. 10 H.P. motors and controls, forced feed lubrication. 21x27 bolster 4½″ stroke. In both Single and Double Action Models. Like new.

No. 6 BLISS 90-125 Ton Capacity, straight side Punch Presses, late model. With scrap cutters, roll double roll feeds, bolster, 15 Hp motors and controls, forced feed lubrication. 25x30″ bolster, 5½″ stroke. In both Single and Double action models. Like new.

#62, 62A, 162 BLISS Presses, 35 Ton Cap., late models. Comp. with all elec. equip.

1—#87 BLISS Press, 175 Ton cap. 32″ stroke, late model.

#666 Toledo, Knuckle Joint Press. 1000 ton cap. 37x21 bolster, 5″ stroke, very good condition, all electrical equipment.

SPOT WELDERS IMMEDIATE DELIVERY 5-300 KVA, Brand new. 5 year guarantee.

PAUL'S MOTOR AND MACHINERY SUPPLY CO.

MONA MEMBER

Detroit 8, Mich.
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CONSIDER THESE VALUES

For Better Performance

10″ x 36″ Norton Plain Hyd. Grinder, 1941.

Japanning Oven, Newcomb-David 13′ x 7′ x 5½′, gas fired. Complete with I beam. Fan and Reeves Drive.

24″ Springfield Shaper

#11 Polymatic Form & Cut-off 5/16″ capacity. Excellent condition.

Ames Precision Univ. Bench Mill, new.

#1B Kearney & Trecker Univ. Mill, Dividing Head, Vise, Motorized.

#4 Gisholt Univ. Turret Lathe, Hyd. Speed Selector, 1941.

These and other useful items REASONABLY PRICED and ready for IMMEDIATE DELIVERY AT

OTT MACHINERY SALES, INC.
546 Second Ave., Detroit 26, Mich.
CAdillac 3103

UNUSUAL VALUES

Blueprint machines, printer-washer-dryer
Rivett Ball Brg. Precision Screw-Machine
Simmons No. 1A Micro Milling Machine
Drills, high speed single & multiple spindle
Drills, 21″ Rogersford Bk. Grd. Fr. Feed, New
Drills, sensitive, 2 and 4 Spindle
Drill, #25 Foot-Burt ,motor driven
Drills—New—18″ Royal Motor driven (10)
Gear cutter, Brown & Sharpe #3—26
Gear Cutter, Gould & Eberhardt 42″
Grinder, Webster and Perks #1-¾ motor drive
22″ Buffalo Pr. Fd. Motor Drive, New
16″x6′ Hendey Lathe, Quick Change Gear
Magic Chucks #1-2 & 3 and Collets
Pipe Machine, 2″ Oster motor drive
Planer 24″x24″x8′ Pease, motor drive
Punch & Shear, two ½″ & ⅝″ capacity
Shaper, 24″ Gould & Eberhardt
Turret Lathe, 2″ Acme & Warner & Swasey
Welders—Arc & Spot in Stock—New

Outfit: about 27 fine machine tools, drills, lathe, and 5 milling machines, pulsin and Uni. Tel us definitey what you want as our list is incomplete and only partial.

The above list is only a fraction of our stock which changes almost daily, therefore, tell us definitely what you want since we are adding considerable number of machines to our stock which are too many to list. What we have today may be sold tomorrow, so a list is really not dependable.

THE OSBORNE & SEXTON MACHINERY CO.
COLUMBUS, OHIO

NEW

Power Presses 52" & 72"
Spot & Arc Welders

Abrasive No. 1½ Surface Grinders, M.D.

Racine 6 x 6″ Hacksaws, M.D.

AARON MACHINERY CO., INC.
45 CROSBY STREET NEW YORK, N. Y.

SHEET METAL MACHINERY

NEW and USED—Hand and Power Brakes, Shears, Forming Rolls, Folders, Punches, Rotary Machines, Stakes, Spot and Arc Welders.

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B. D. BROOKS, INC.
361 Atlantic Ave., Boston, Mass.

NEW—USED MACHINERY and EQUIPMENT

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THE LARGEST MACHINE TOOL PLANT IN THE U.S.A.

Eastern OFFERS FROM STOCK

DEVOTED EXCLUSIVELY TO REBUILT MACHINERY

AIR TOOLS

No. 00 Ingersoll-Rand Multivane Air Hand Grinders, new (10)
No. 0 Ingersoll-Rand Multivane Air Hand Grinders, new (3)

AUTOMATICS

No. 4D Potter & Johnston, m.d.
No. 6A Potter & Johnston, m.d.
No. 6C Potter & Johnston, m.d.
14" Fay, Flanders Type, m.d.
20x25" Jones & Lamson Automatic, m.d., latest
4 spindle 3/8" Cleveland Model M, m.d.
4 spindle 2¼" Cleveland Model K, m.d.
4 spindle 2" Cleveland Model M, m.d.
2¼" Cleveland Model A, m.d.
2½" Cleveland Model A, m.d.
2½" Gridley S.S., m.d.
4¼" Cleveland Model A, m.d.
5½" Cleveland Model A, m.d.
6" Cleveland Model A, m.d.
7¾" Cleveland Model A, m.d.

BOLT THERADING MACHINERY

¾" Economy Style R, m.d.
3 spindle 1¼" Acme, cone
2 spindle 1¼" Landis, m.d.

HORIZONTAL BORING MILLS

No. 0 Giddings & Lewis, m.d., 3⅛" bar
No. 21 Lucas, m.d., 2½" bar
No. 45 Giddings & Lewis, m.d., 4½" bar, long bed
4" bar Detrick & Harvey Floor Type, m.d.
4" bar Landis Floor Type, m.d.
4" Niles, m.d.
4½" Niles, m.d.
5½" bar Niles Table Type, m.d.
6" bar Niles Floor Type, m.d.
Morton 60" stroke Boring Mill and Traveling Head Planer, m.d.
10" bar Sellers Floor Type, m.d.

BROACHING MACHINES

Colonial VAS-5-42 Single Ram Hydraulic Vertical, m.d., latest
Cincinnati Mill Broach, m.d., 10" spindle
No. 75 H.P. LaPointe Horizontal Hydraulic, m.d., 37½" tons, max. stroke 150", latest type
No. 4 LaPointe of Hudson, s.p.d.

UNIVERSAL MILLING MACHINES

No. 2L Cincinnati, m.d. in base, latest
No. 3 Cincinnati, m.d.
No. 42 Brown & Sharpe, m.d.

PLANERS

30"x30"x10' American, 1 head, belt
30"x30"x10' American, 2 heads, belt
30"x30"x14' Gray, 2 heads, belt
32"x32"x16' Gray, 2 heads, belt
36"x36"x10' Niles, 2 heads, belt
36"x36"x12' Powell, 2 heads, belted m.d.
36"x36"x16' Gray, 2 heads, belted m.d.
36"x36"x18' Niles-Bement-Pond, 2 heads, var. speed m.d.
36"x36"x20' Cincinnati, 2 heads, belt
36"x36"x20' Gray, 2 heads, belt
38"x38"x20' Gray, 2 heads, belt
42"x42"x26' Cincinnati, 4 heads, p.r.t., box table
42"x42"x26' Gray, 2 heads, belted m.d.
48"x48"x18' Detrick & Harvey, 4 heads, reversing m.d.
48"x48"x28' Cincinnati, 4 heads, reversing m.d., box table
48"x48"x30' Cincinnati, 4 heads, m.d.

PLANERS (Continued)

48"x48"x40' Sellers, 2 heads, reversing m.d.
50"x48"x32' Niles-Bement-Pond, 4 heads, reversing m.d.
66"x60"x40' Niles-Bement-Pond, 4 heads, p.r.t., reversing m.d.
72"x72"x24' Niles-Bement-Pond, 4 heads, reversing m.d.
72"x72"x36' Niles, 4 heads, reversing m.d.
96"x72"x18' Pond, 4 heads, m.d.
144"x144"x20' Mesta, 4 heads, reversing m.d., latest

SAWS

7½ H.P. Cincinnati Elec. Tool Co. Abrasive Cut-off Machine, type JCAW
30" Wright Band Saw, m.d.
Gustav Wagner Cold Saw, m.d.
No. 138 Espen-Lucas Cold Saw, m.d.
No. 3 and 8 Nutter & Barnes Cold Saws
No. 5 and 6 Cochran-Bly Cold Saws

SHEET METAL MACHINERY

Southwark Rotary Metal Cutter, 36" throat, 3/8" cap.
8' Niles-Bement-Pond Flanger, hand operated
No. 2 Campbell Nibbler, m.d.

TAPPERS

6 spindle ½" Acme Semi-Automatic Nut, m.d., latest
½" Rickert & Shaffer Vertical, belt
No. 5 Webster & Perks 5 spindle Vertical Nut, belt

DISC GRINDERS

No. 20 Gardner Comb. Disc Grinder & Roll Sander, m.d.
No. 4 Gardner, m.d.
7½ H.P. U.S. Electrical Tool Co., new
7½ H.P. Standard, new

INTERNAL GRINDERS

No. 16-A—16" Bryant, m.d., latest
No. 16—22" Bryant, m.d., latest
No. 16RS Bryant, m.d., latest
No. 6, 10, 20 Bryant, belt
No. 24—21" Bryant, m.d.
No. 49 Heald Single End Boremetic, m.d.
No. 72A Heald Plain, m.d.
No. 72A3 Heald Sizematic, m.d.
No. 72A3 Heald Gagematic, m.d.
No. 73 Heald Airplane Cylinder, new
No. 74 Heald, m.d.
No. 172 Heald Cap, m.d., new

SURFACE GRINDERS

No. 10 Blanchard, m.d.
No. 11 Blanchard, m.d., latest
Builders Iron Foundry Co. Surface, m.d.
14" Pratt & Whitney Vertical, m.d.
No. 16—26" Blanchard, m.d.
No. 18—30" Blanchard, m.d., latest
16" Arter Model A3, m.d., new
No. 25A—16" Heald Rotary, m.d., latest
No. 25A—24" Heald Rotary, m.d., latest
No. 33 Abrasive Vertical, m.d.
30"x18"x6' Springfield Planer Type, m.d.
No. 76D Baldwin-Tuthill Knife, m.d.
22" Pratt & Whitney Vertical, m.d.
54" Bridgeport Knife, belt

SHAPERS

24" Cincinnati Traveling Head, m.d.
24" Gould & Eberhardt H.D., gear box, m.d.

ROLLS

No. 4 Hilles & Jones Straightening Rolls, m.d., cap. 8' of 1" plate
No. 30 Bertsch Plate Bending Rolls, m.d., 36' between housings

CENTERLESS GRINDERS

No. 2 Cincinnati, m.d., brand new, latest type, 1945 machine
No. 2 Cincinnati, m.d., pract. new
No. 2 Cincinnati, m.d., older type
No. 3 Cincinnati, m.d., brand new, latest type, 1945 machine
Cincinnati Valve Seat Grinder, m.d., cap. 3/8" valve stems

THREAD GRINDERS

No. 33 Excello Precision, m.d., latest, pract. new

CYLINDRICAL GRINDERS—PLAIN

No. 10 Brown & Sharpe Self-Contained, s.p.d.
No. 11 Brown & Sharpe Self-Contained, m.d.
No. 5—size 3x18" Brown & Sharpe, m.d., pract. new
6x18" Cincinnati Hydraulic, model EA, m.d.
6x18" Landis Self-Contained, m.d.
6x32" Fitchburg Type A, m.d.
8x36" Cincinnati Saddle Type, m.d.
10x24" Landis, m.d.
10x36" Cincinnati Hydraulic, model EA, m.d.
10x48" Brown & Sharpe, belt
10x48" Landis Type C Hydraulic, m.d., latest
10x72" Landis Self-Contained, m.d.
12x36" Modern, belt
12x36" Landis Self-Contained, m.d.
12x48" Cincinnati Self-Contained, m.d.
12x48" Modern, belted m.d.
12x48" Cincinnati Self-Contained, m.d.
12x72" No. 16 Brown & Sharpe, belt
12x96" Landis Self-Contained, m.d.
14x18" Cincinnati Self-Contained, m.d.
14x48" Cincinnati Self-Contained, m.d.
14x52" Norton, motorized
14x72" Cincinnati Self-Contained, m.d., Filmatic Spindle
16x72" Landis Self-Contained, m.d.
20x120" Landis Self-Contained, m.d., with gap
26x96" Landis Self-Contained, m.d.

CYLINDRICAL GRINDERS—UNIVERSAL

12x24" Cincinnati Self-Contained, Filmatic Spindle, m.d.
12x30" Landis Hydraulic, m.d.
12x30" Brown & Sharpe, belt
No. 13 Brown & Sharpe Universal & Tool, m.d., latest
12x36" Cincinnati Self-Contained, m.d.
12x36" Cincinnati, belt
16x66" Landis, belt
12x48" Norton Hydraulic, m.d., latest

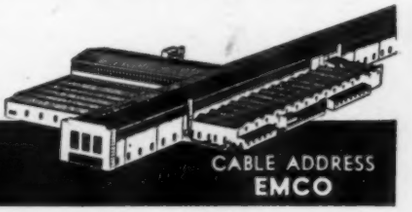
SLOTTERS

10" Newton, cone
12" Bement-Miles, m.d.
15" Canada, m.d.
18" Dill, m.d.
48" Niles-Bement-Pond Geared, reversing m.d.

MISCELLANEOUS

Gisholt Precision Balancing, m.d.
Detrick & Harvey 2 spindle Profiler, belt
Anderson Filing Machine, m.d.
No. 12M Morey 2 spindle Profiler, m.d.
No. 12 Pratt & Whitney 2 spindle Profiler
No. 11 Cochran-Bly Saw Sharpener
Wagner Saw Sharpener, belt

MORE THAN 2,000 MACHINES IN STOCK.
LET US QUOTE ON YOUR REQUIREMENTS.



THE EASTERN MACHINERY COMPANY
1004 Tennessee Avenue, Cincinnati 29, Ohio
MElrose 1241
CABLE ADDRESS EMCO

NEW—SPOT DELIVERY

PRESSES

Make	Tons	Stroke	Type
(14) V & O #0	5	2"	OBI—Dial Feeds
(15) V & O #2	17	4"	OBI—Dial Feeds
(15) Wat-Farrel	25	3" up—3" down or single action 3"	C Frame-dbl action, dial feeds (or single action)

SAWS Kalamazoo Metal Cutting Band Saws, horizontal

SHEARS (Foot) Frederick complete 36" x 18 G cap.
(Power) Frederick complete with motor, gauges, 10' x 18 G
(3) (Power) Pexto 6' x 16 G Gap

BRAKES Press type, all steel, Lynn Hydraulic, motor self contained, 54" x 14 G (also used for punching)

USED POWER PRESSES

Make	Tons	Stroke	Die Space	Shut	Type
(8) Wat-Farrel	7½	1½"	8½" x 12"	8"	SS Single action C Gap frame
(3) Bliss #18	10	1½"	8½" x 14½"	7"	OBI Geared or plain
Max Ames	15	2"	9" x 18½"	6"	OBI-Roller Feed
Bliss #172A	22	1½"	5" x 4"	7"	3" x 2" End Wheel
Bliss #20	30	3"	14" x 22"	8"	OBI
Bliss #680	35	1–2½"	2" x 10½"	7"	Arch-DA
(3) Mystic #5A	40	6"	14" x 17"	14"	Embossing & Molding for Plastics
Torrington	40	1–2"	23" x 16"	6¼"	SS-DA
Bliss #1B	43	3–6"	14" x 28"	8½"	SS-DA, Gap
(2) Bliss #52	45	2"	14" x 15"	9½"	SS-DA
Wat-Farrel	50	Eyelet			6 Plunger
Toledo #54	60	3"	18" x 18"	12"	Trimmers-Shear
Bliss #67	75	2"	18" x 18"	11"	SS-Trimming
(2) Bliss #7	180	2" & 5"	28" x 38"	15"	SS-DA, Geared, Air Clutch (or single action)
Toledo #59½S	500	8"	31" x 31"	29"	SS-DA, Twin Drive
HPM	1000	42"	72" x 110"	66"	Pump and Motor 1944 Fast Traverse
Lake Erie Hydraulic 1320		38"	80" x 60"	12"	Pump and motor 1943
Lake Erie Hydraulic 2500		36"	133" x 120"	42"	Pump and Motor 1944

BRAKES (Power) with motors
D & K 5' x 10 G Box & Pan 13 fingers
D & K 8' x 16 G apron
Ohl 10' x 10 G (Press)
New Lynn 56" x 14 G Press Hydraulic-motor self-contained (also used for gang punching)

SHEARS (Power) with motors
Niagara 5' x 14 G (gap)
(3) Pexto 6' x 16 G (gap)
Bliss 24" x 5/16"

IRONWORKER
Stahl-Schaatz Comb. Punch & Shear 4" x 4" x 3/8", all steel, motor

(7) TURRETS—Denver 6" motor in base air chuck, late

KINGS COUNTY MACHINERY EXCHANGE

394 ATLANTIC AVENUE, BROOKLYN 2, N. Y.
Phones: TRiangle 5-5237, 5-5212, 5-5213
WIRE — PHONE — WRITE

MONA MEMBER

Rare Values

BORING MILLS
Horiz. 2½" bar, Cleveland, M.D.
Horiz. 3" bar, Universal Triway.
Horiz. 3⅛" bar, No. 0 G & L.
Horiz. Floor Type 3½" Landis.
Horiz. 5"x20' Barrett, No. 2
Horiz. No. 44 Univ. 4½" bar, Triway.
Horiz. Fl. Type, No. 35 Landis, 3½" bar.
36" Bullard "New Era" M.D.
36"-44" N-B-P, Tur. & Side Hds.
42" King, Side Head, M.D.
60" N-B-P, 2 Hds., M.D.

DRILLS
3-Spdl. Avey, No. 2 M.T.
3-Spdl. 20" Barnes, M.D.
6-Spdl. Moline, No. 7-D.
Drills, Radial, 3' Cincinnati-Bickford, M.D.
Radial, 5' Western T.A., M.D.
Radial, 6' Cin.-Bickford, M.D.
20" Barnes, Camelback.
26" Colburn, No. 5 M.T., S.P.D.
42" Barnes, sliding head.
No. 513 Baker, No. 6 M.T.

GEAR CUTTERS
Planer, bevel, 54" Gleason.
104"x22" Gould & Eberhardt.

GRINDERS
Centerless, No. 2 Cincti., M.D.
Cyl. Plain, No. 11 B&S, 6"x32".
Cyl. Plain, 14"x72" Norton, M.D.
Disc, No. 14—30" Besly, S.P.D.
Drill, Oliver Twist, 1½", M.D.
Internal, Heald, No. 70, M.D.
Internal, Heald, No. 72A5, M.D.
Knife, 120" Springfield, M.D.
Surf. Rot. No. 25 Heald, chk. 16" dia.
Surf. vert., No. 16 Blanchard.
Surf., vert., 48"x18" P & W.
Surf., vert., 40"x12" P & W.
Univ., No. 2 B & S, 14"x36".

LATHES ENGINE
4"x60" Lo-Swing, G.H., M.D.
18"x6' Greaves-Klusman, Q.C.G.
14"x6' Hendey, Q.C.G., T.A.
26"x12' Sch. & Baye, Q.C.G.
27"x16' Boye & Emmes, G.H. (1942).
Lathes, Engine, 27"x18' Niles "Time Saver,"
30"x14' Boyes & Emmes, Q.C.G.
36"x22' N-B-P, Grd. Hd., Q.C.G.
38"x19' Putnam, Grd. Hd.

LATHES TURRET
16" American Brass.
18" Libby, 3⅜" H.S.
2A W & S, Univ., 2½" H.S.
3A W & S, Univ., 4¾" H.S.
No. 4 W & S, Univ., 1 27/32".
No. 6W Acme, Univ. 3".

MILLING MACHINES
Duplex, 24" Cinc., Auto., M.D.
Keyway, No. 7 Burr, tbl 12½x96".
Plain, No. 1H Bickett, B.D.
Plain, No. 1½B K & T, M.D.
Milling Mches., Plain, No. 3B B&S, rack cut.
Plain, No. 3-S Cinc., S.P.D.
Plain, No. 4 Cincinnati, B.D.
Plain, No. 4B, Brown & Sharpe.
Plain, No. 5 Cincinnati, M.D.
Planer Type, 30x36x12' Ingersoll.
Milling Mches., Univ., No. 1 Cinti., M.D.
Vert., No. 1 & 2 Knight, M.D.
Vert., No. 2A Milwaukee, M.D.
Vert., No. 3 & 4 Cincinnati.

MISCELLANEOUS
Air Comp. Ing.-Rand Vert. 445 c.f.
Bolt Threaders (2) Dbl. Hd., 2" Murchey (New 1945).
Boring Bars, 4½"x10', 5"x12'.
Broach, Hyd., XA Oilgear, 60" stroke.
Broach, Vert., LaPointe, Type SRV5-42".
Hammer, Power, 50# K & R.
Hammer, 1,000 lb. B & S, Board Drop.
Hoist, 1 ton Shepard, 110 V, D.C.
Honing Mch., No. 1 Micromatic.
Planer, 10"x10'x26' Pond, 4 hds., m.d.
Press, No. 355 Toledo Reducing.
Profiler, No. 13 P & W, M.D.
Pumps, Triplex, Worth. gpm. 102.
Rivet Spinner, SP-75 Airflex, 5/32".
Roll, Corrugating, 146" Streine, 2½ P.
Saw, Fric., No. 3 Ryerson, M.D.
Saw, Hot, 54" United, Sli. Fr.
Saw Sharpener, No. 11 Covel 8"-12".
Shaper, Vert., 10" P & W.
Shaper, 16" Milwaukee, m.d.
Shear, Alligator, No. 1 Canton, cap. 1½".
Shear, O.E. Bar, United, 2½" sq.
Shear, Plate, 10'x¾" Cleveland, 24" thr.
Shear, Plate 132"x1½" Morgan, 26" thr.
Tapper, No. 2X Garvin, B.D.
Tapper, ½" Rickert-Shafer.

MULT-AU-MATICS
4—6 Spindle Bullard, Type A, Mult-Au-Matics, cap. 12" dia., 7¼" in Hgt., 4¼" in Hgt., 6-3-jaw Univ. 14" dia. chucks, 15 H.P. West. AC Motors, very good condition.

LANG *Machinery Company*

28th St. and A. V. R. R. Phone Grant 3595 Pittsburgh 22, Pa.

CLEARANCE SALE

High Speed Straight Shank Drills Cleveland List 950, Long Set

PCS.	SIZE	PCS.	SIZE
5	11/64 L.H.	6	43/64 R.H.
1	21/64 L.H.	1	47/64 L.H.
1	23/64 L.H.	23	57/64 R.H.
1	3/8 L.H.	2	29/32 R.H.
9	43/64 L.H.		

AT 75% OFF LIST.

High Speed Straight Shank Drill Wire Gauge (L.H.) Clev. List 918

PCS.	SIZE	PCS.	SIZE
217	11	1682	76
2724	71	1528	77
852	72	2755	78
1481	73	1796	79
2016	74	3352	80
1944	75		

AT 75C PER DOZEN.

Black Drills, Straight Shank

ITEM	PCS.	SIZE	ITEM	PCS.	SIZE
1	4	27/64	11	31	11/16
2	10	29/64	12	34	23/32
3	5	15/32	13	22	3/4
4	4	31/64	14	31	49/64
5	26	33/64	15	35	13/16
6	34	17/32	17	29	25/32
7	31	35/64	18	31	53/64
8	31	37/64	19	32	27/32
9	29	39/64	20	29	55/64
10	28	21/32			

ITEMS #1 TO 6, $3.00 EACH.
ITEMS #7 TO 20, $4.00 EACH.

High Speed Precision Ground Machine Taps R. H. M'f'rs: Hanson, Card, Greenfield, Wood, Bath, Spencer, Winters, Pratt & Whitney

PCS.	SIZE	FLUTE	STYLE
2876	.0096	2	Plug
16	.0096	2	Spiral
739	4-32	2, 3	Spiral & Plug
547	4-32	3	Plug
987	4-48	3	Plug
1271	4-60	2, 3	Spiral
900	5-44	2	Spiral
50	5-44	3	Plug
559	5-50	2, 3	Spiral & Plug
876	5-80	2 Thd.	Chamfer Plug
230	5-80	3	Plug
894	6-36	2	Spiral
728	6-36	3	Plug
276	8-30	4	Plug
212	8-30	2	Spiral
2568	10-48	4	Plug
2120	10-48	2	Spiral
1263	10-64	2	Spiral
1553	12-24	2	Spiral
437	12-28	2	Spiral
528	12-28	4	Plug
1773	14-20	2, 4	Plug
937	14-24	2	Spiral
254	14-24	4	Plug
523	14-28	4	Plug
105	5/32-32	4	Plug
449	11/32-32	3, 4	Plug
224	11/32-32	3	Spiral
247	1/4-24	2, 4	Spiral
8	5/16-24	2	Spiral
19	3/8-12	4	Plug
132	3/8-18	4	Plug
198	3/8-24	3	Spiral
315	3/8-24	4	Plug
244	7/16-24	2	Spiral
128	7/16-28	3	Spiral
12	9/16-18	4	Spiral Alum.
7	9/16-18	4	Plug
6	5/8-12	4	Plug
124	11/16-24	4	Plug
68	3/4-20	4	Plug
98	3/4-14	4	Plug
25	1-3/16-24 Long Set	6	Plug
76	1-3/16-24 Short Set	6	Plug

AT 85% OFF LIST.

High Speed Precision Ground Machine Taps (L.H.) M'f'rs: Card & Bath, Bath & Winter

PCS.	SIZE	FLUTE	STYLE
383	12-24	2	Spiral
144	14-20	2	Spiral
309	14-24	2	Spiral
240	5/16-25	2	Spiral
28	9/16-12	4	Plug

AT 85% OFF LIST.

High Speed Straight Shank Machine Chucking Reamers. Cleveland List 630

PCS.	SIZE	PCS.	SIZE
1	.0598	107	.184
56	.0645	88	.1865
228	.065	1	.1895
218	.073	1	.190
71	5/64	89	.192
99	.0918	1	.195
12	.0980	120	.1965
9	7/64	124	.2165
114	.098	260	7/32
118	.1415	74	.2182
114	.154	77	.2195
112	.155	1	.2385
103	.1575	47	15/32
70	.158	49	31/64
98	.1585	100	35/64
106	.166	1	9/16
104	.1835		

85% OFF LIST.

High Speed Straight Shank Machine Chucking Reamers

PCS.	SIZE	STYLE
119	.058	Spiral Clev. List 611
96	.0593	Spiral Clev. List 611
101	.158	Spiral Clev. List 611
96	.158	Spiral Clev. List 11
5	.158	Spiral Pratt & Whitney

85% OFF LIST.

Carbon Steel Acorn Dies Greenfield

PCS.	SIZE	BLANK	TO CUT
354	.0096	1	Steel
493	3-56	0	Steel
6	5-40		Steel
53	6-40	2	Copper
212	10-64	1	Brass
11	10-65		Steel
1	12-24		Brass
127	12-28	1	Brass
4	1/8-27	2	Brass
5	1/4-32	1	Brass
1	5/16-18	2	Brass
28	5/16-32	2	Steel
6	5/16-32	2	Brass
107	11/32-32	2	Steel
20	11/32-32	2	Brass
2	7/16-24	2	Brass
23	1/2-24	4	Brass
41	1/2-27	4	Brass
9	5/8-18	3	Steel
5	5/8-40	3	Steel
9	5/8-40	3	Brass
9	5/8-24	3	Brass
18	3/4-24	4	Brass
11	3/4-27	4	Aluminum
4	7/8-18	4	Brass

85% OFF LIST

High Speed Acorn Dies Greenfield & Union

PCS.	SIZE	BLANK	TO CUT
30	8-30	1	Steel
8	10-64	1	Steel
12	10-64	1	Brass
62	12-24	1	Steel
48	12-28	1	Brass
6	14-20	1	Brass
8	14-24	1	Brass
10	1/4-24	1	Brass
149	5/16-32	2	Steel

85% OFF LIST.

High Speed Acorn Dies M'f'd by Greenfield

PCS.	SIZE	BLANK	TO CUT
232	3/8-36	2	Steel
3	3/8-36	2	Brass
46	11/16-24	3	Steel
1	3/4-24		Steel
80	3/4-24	4	Brass
97	3/4-24	4	Steel
8	3/4-27	4	Aluminum
12	7/8-18	4	Brass
22	7/8-18	4	Steel

85% OFF LIST.

Go and No Go Plug Thread Gauges M'f'rs: Pratt & Whitney, Hanson & Whitney, Bath, Greenfield

No Go

Pcs.	Size	Class	Pcs.	Size	Class
53	1-64		22	10-64	3
31	2-56	3	19	10-64	2
67	2-64	3	6	12-24	
14	3-48	2	20	12-28	3
25	3-48	3	1	1/8-80	2
113	3-56	3	7	1/4-24	2
62	4-32	2	18	1/4-32	2
5	4-36	2	3	9/32-32	3
9	4-60	3	61	7/16-28	
16	5-40	2	4	3/4-20	
31	5-50	2	4	15/16-24	
61	6-40	3	14	1-1/8-18	
11	8-56	2			

Go

Pcs.	Size	Class	Pcs.	Size	Class
62	1-64	2	134	5/16-32	
43	2-56	3	51	11/32-32	
78	4-32		22	3/8-16	
47	4-36		418	3/8-24	
8	4-60		67	13/32-40	
60	5-44		24	7/16-14	
57	5-50		92	7/16-28	
785	6-32		3	7/16-40	
9	8-56		73	1/2-24	
62	10-64		94	9/16-24	
11	12-24		33	5/8-24	
39	12-28		21	5/8-40	
10	1/8-50		1	11/16-24	
5	1/8-80		53	11/16-40	
45	1/4-18		3	3/4-24	
188	1/4-24		4	7/8-20	
61	1/4-32		18	.903/14	
3	9/32-24		4	15/16-24	
3	9/32-32		7	1-3/16-24	
49	5/16-24		6	1-3/8-18	

AT 85% OFF LIST PRICE.

Setting Thread Gauges—Go & No Go

Pcs.	Size	Style	Pcs.	Size	Style
			3	1-72	Plug
10	3-56	Plug	1	13/32-40	Plug

AT 85% OFF LIST PRICE.

Cylinder Plug Gauge End Members Go & No Go

5000 pcs., sizes .0213 to 6.740, Class X, XX, Y, Z. Manufactured to A.G.D. Standard. At $1.00 ea.

Split Ring Thread Gauges, Class 2 & 3 M'f'rs: Hanson & Whitney, Pratt & Whitney, Greenfield, Bath

No Go

PCS.	SIZE	PCS.	SIZE
14	1-64	24	7/16-24
6	4-32	11	7/16-28
25	4-36	12	1/2-20
7	4-60	5	1/2-28
15	5-40	3	9/16-27
14	5-44	16	9/16-18
30	5-50	4	5/8-18
12	8-56	2	5/8-24
71	10-64	5	11/16-24
43	12-24	36	11/16-40
20	5/32-40	1	13/16-32
76	1/4-24	3	7/8-14
20	5/16-24	24	7/8-18
6	3/8-24	1	7/8-24 L.H.
29	13/32-40	5	7/8-32
5	7/16-14	3	1-1/8-18

All of the drills, taps and dies are in the original packages.

STAINLESS STEEL SALES CORP.

2409 NORTH SECOND STREET **REgent 9-4027** **PHILADELPHIA 33, PA.**

LATE MODEL MACHINE TOOLS AVAILABLE

BORING MILLS

33" UNIVERSAL HORIZONTAL, M.D.
24" BULLARD VTL, M.D.
36" BULLARD VTL, M.D.

DRILLING MACHINES

3' 11" AMERICAN "HOLE WIZARD", M.D.
4' 13" CINCINNATI-BICKFORD RADIAL, M.D. through Gear Box
2, 4, & 6 spindle AVEY, ALLEN and LELAND-GIFFORD DRILLS, M.D.

GEAR MACHINERY

#64A FELLOWS GEAR SHAPER, M.D.
#36BM GOULD & EBERHARDT 3-spindle GEAR ROUGHERS, M.D.
GLEASON BEVEL GEAR GRINDER
#17 GLEASON Hypoid GEAR CUTTER
#7A type FELLOWS GEAR SHAPER
9" P&W HYD. GEAR GRINDER

GRINDERS

#70-A HEALD INTERNAL, M.D.
#72-A3 HEALD INTERNAL, M.D.
#74 HEALD INTERNAL, M.D.
#81 HEALD "GAGE-MATIC", M.D.
#81 HEALD "SIZE-MATIC", M.D.
4"x12" LANDIS "H" Pl. Cyl., M.D.
10"x18" NORTON Hyd. Cyl. Grinder

GRINDERS (Continued)

14"x168" NORTON TYPE "C" Cyl. M.D.
12" ARTER ROTARY SURFACE GRINDER, M.D.
#11 BLANCHARD ROTARY SURFACE M.D. 16" & 20" chucks
#49 EXCELLO TOOL GRINDER, M.D.
#4T SELLERS TOOL GRINDER, M.D.
6"x48" THOMPSON BROACH GRINDER, M.D.
20" FITCHBURG SPLINE GRINDER, M.D.
#5A BRYANT CHUCKING GRINDER, M.D.

LATHES

18"x72" MONARCH 8-speed GEAR HEAD, M.D.
22"x96" MONARCH MODEL "M" M.D.
27"x20' bed LEHMAN LATHE, two carriages with T.A., M.D.
42"x132" centers AMERICAN "SUPER PRODUCTIVE", M.D.
50"x17' centers LEBLOND "BIG SWING", M.D.
SUNDSTRAND Automatic Lathe, M.D.
12"x21" FAY AUTOMATIC LATHES, M.D.

MILLING MACHINES

#2MS CINCINNATI VERT. MILLER
#3MS CINCINNATI VERT. MILLER
#4MS CINCINNATI PL. MILLER
#4H K&T VERT. MILLER, M.D.
#5H K&T PL. MILLER, M.D.
U.S. MULTI-MILLERS, M.D.

MILLING MACHINES) (Continued)

#1H-12 K&T MFG. MILLER
12"x18" MILWAUKEE SIMPLEX MILLER
12"x24" MILWAUKEE SIMPLEX MILLER
#10 BROWN & SHARPE AUTO. MILLER
#12 BROWN & SHARPE AUTO. MILLER
#2-18 CINCINNATI PL. AUTO. MILLER
#2-24 CINCINNATI PL. AUTO. MILLER
#1224 MILWAUKEE DUPLEX MILLER
#5-60 CINCINNATI DUPLEX HYDR. MILLER
4"x9" HANSON-WHITNEY THREAD MILLER

TURRET LATHES

#0 B&S WIRE FEED SCREW MACHINES, M.D.
#4 W&S UNIV. TURRET LATHES, M.D.
#5 W&S UNIV. TURRET LATHES, M.D.
#5 J&L UNIV. TURRET LATHES, M.D.
#1A W & S Univ. Turret Lathes, M.D.
#4 MIDLAND UNIV. TURRET LATHES, M.D.
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#36-F NORTON Hydro-Lap
25-ton Oil Gear Straightening Press
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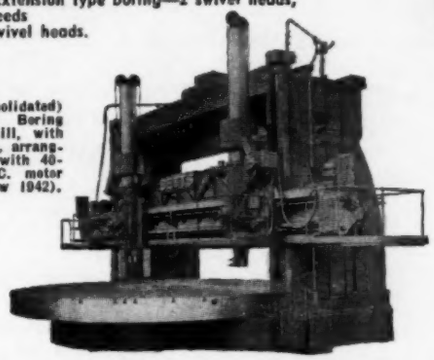

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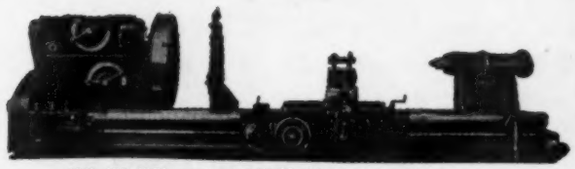

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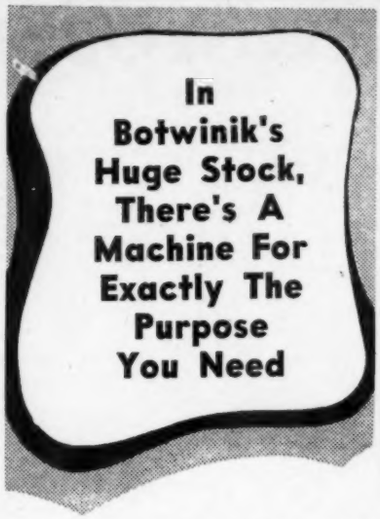

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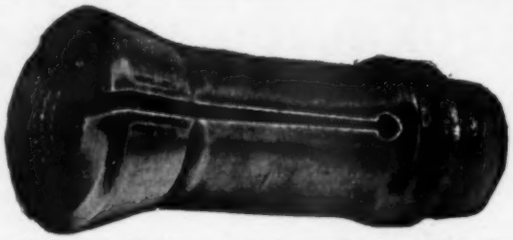

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McCabe 26-42"x14'
26x12' Boye & Emmes 3 step cone, B.D.G.
14"x6', 16"x6' Hendey
9" LeBlond Automatic
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36x22" Putnam, D.C. M.D.
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8" Shap-Rite Shapers
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6x6" Racine Hacksaw

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4', 5' Cincinnati-Bickford
4' Muller, M.D.; 4' 5' Western, S.P.D.
4' American Hole Wizard, M.D.
4' Fosdick

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No. 3S Cincinnati, S.P.D. rapid trav. M.D.
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Hall Planetary Model D Thread Miller
Becker Nos. 3, AB, 5, 6, Vert.
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Rochester No. 5½" B Hammer
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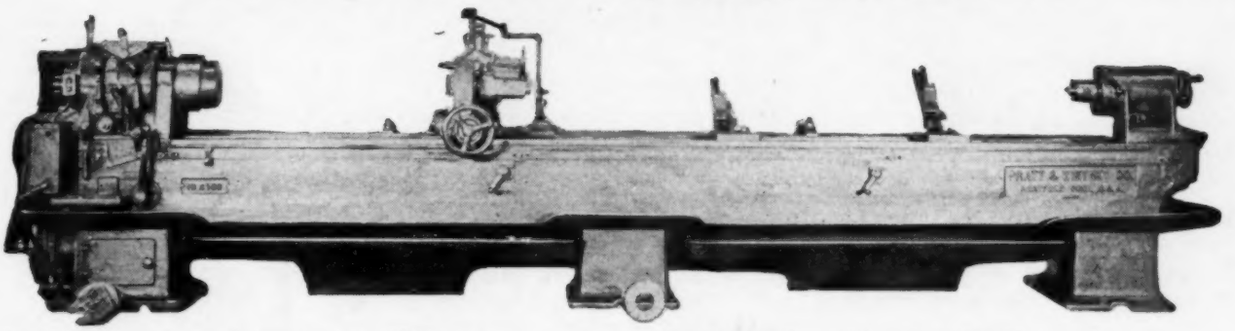

Length that can be cut between centers 168"
Dia. external thread that can be milled 10"
Lead that can be cut with regular gears: minimum, threads per inch 12; maximum, lead 48"
Depth that can be cut 1-9/16"
Collet capacity 3½"
Follow rest capacity 3½"
Index ring, regular, number of notches 12
Lead screw, threads per inch 2
Speeds: work spindle speed changes (by slip gears) 17; spindle speed, min. r.p.m. 0.08; spindle speed, max. r.p.m. 1.27; cutter spindle speeds (5) 44 to 144 r.p.m. with miscellaneous collets and equipment. Arr. for motor drive with 3 H.P. A.C. motor

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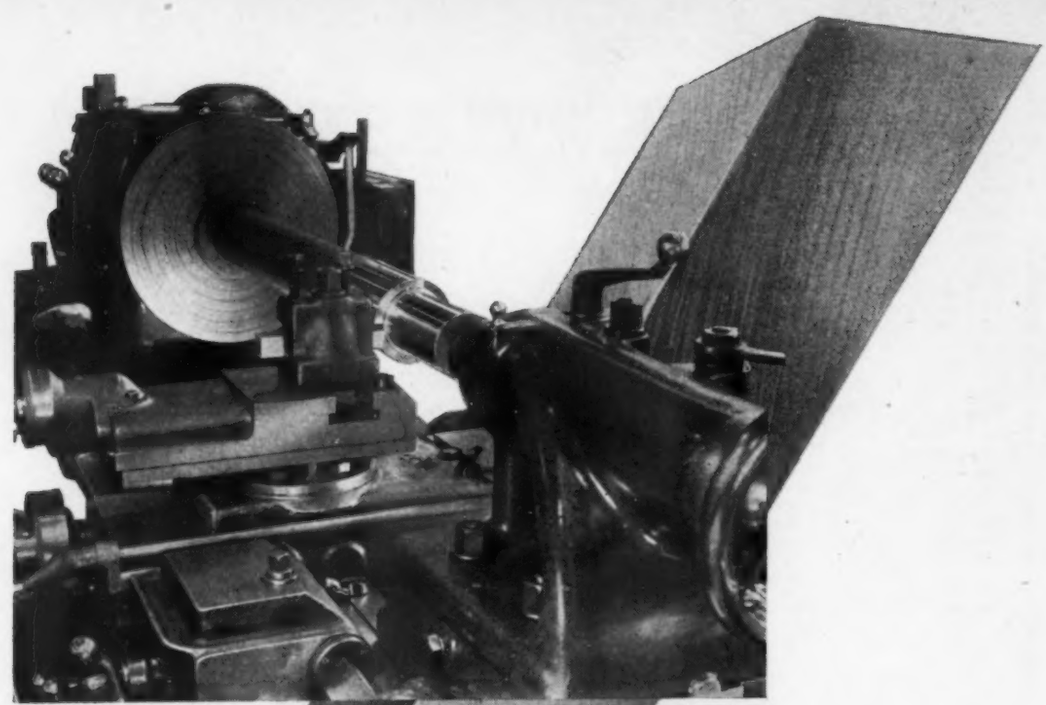

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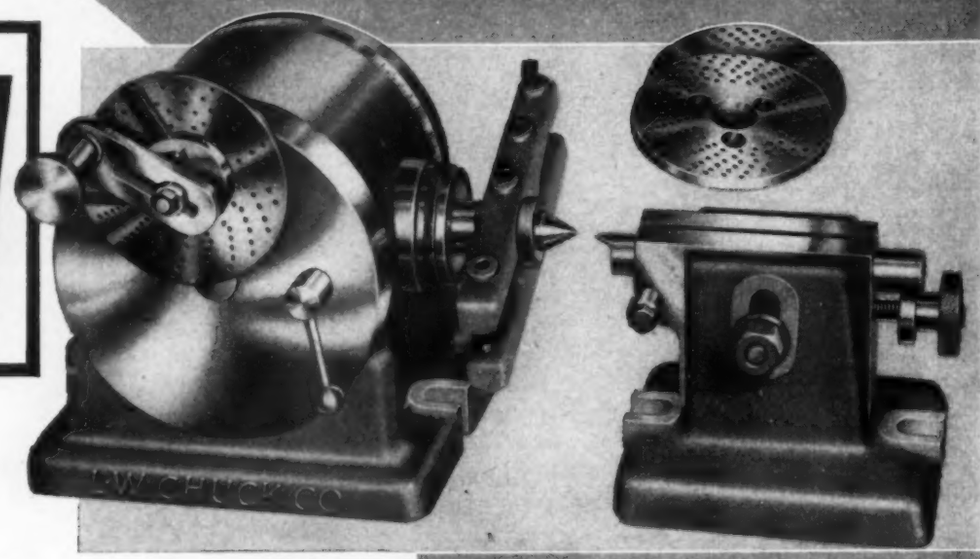

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New electrode simplifies tough-to-weld jobs

"Shield-Arc LH-70" is a new heavily coated electrode designed primarily for the welding of steels of poor weldability. Its as-welded properties are 75,000 to 80,000 lbs. per sq. inch and 25% to 30% elongation in 2". Stress relieved tensile strength is 70,000 lbs. per sq. in. minimum. Normally it produces a convex bead.

Welds made in high-sulphur steel. Left: Made with mild steel electrode. Right: Made with new "Shield-Arc LH-70" Electrode.

Typical Applications. Experience to date shows that this electrode produces exceptional results in these applications:

Low alloy high tensile steels which cannot be preheated.
High sulphur (free machining) steels.
High carbon, medium carbon steels.
High silicon electrical sheet steel.
For welds to be porcelain-enameled without annealing.

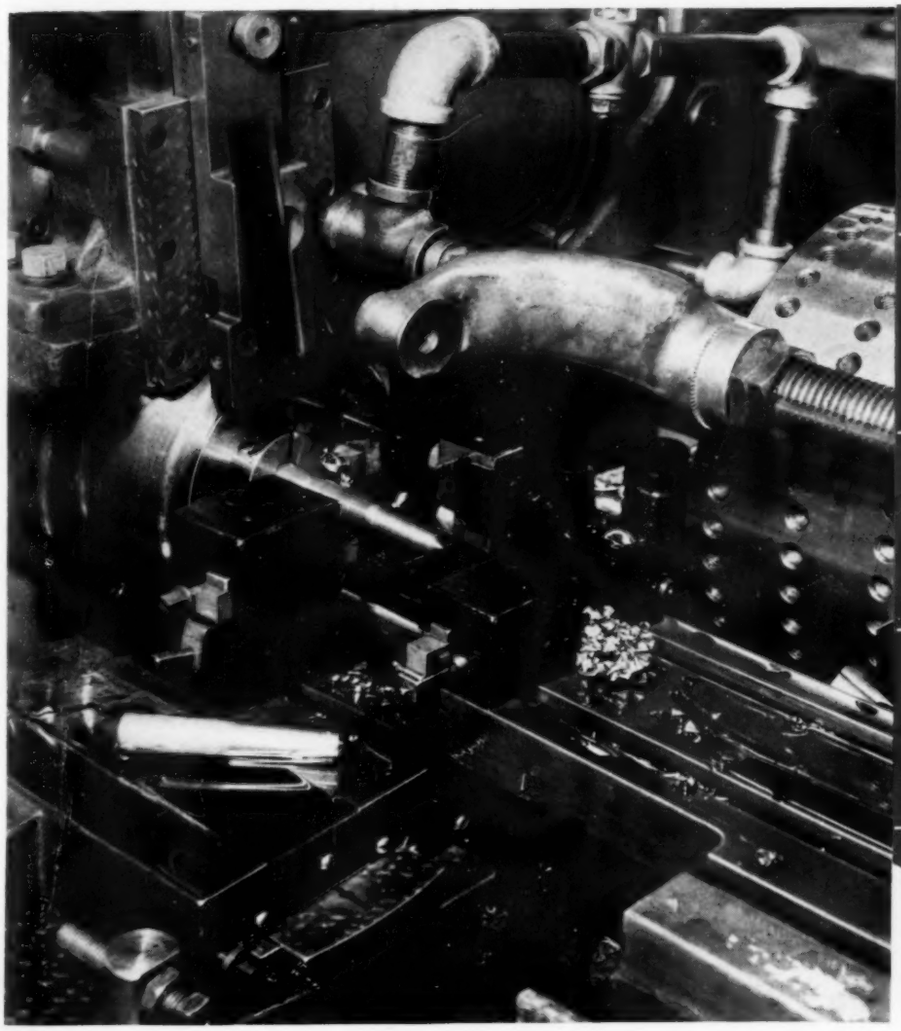
Procedure. Use DC—electrode positive, work negative. Hold a short arc. 1/8" and 5/32" may be used for vertical and overhead positions, single or multiple pass. Make vertical welds from bottom upward. Make overhead welds with stringer beads or narrow lateral weave.

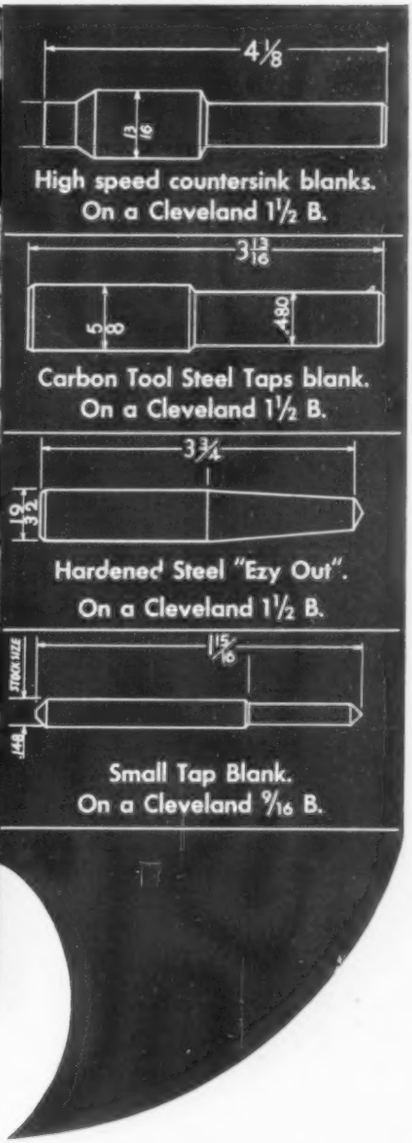
CURRENT RANGE	
Rod Size	Amperes
1/8"	100—135
5/32"	140—190
3/16"	180—250

For further details, call the Lincoln Welding Engineer nearby or write THE LINCOLN ELECTRIC Co., Dept. 211, Cleveland 1, O.

Butt welding medium carbon (.50% C) steel sprocket teeth forgings with the new Lincoln "Shield-Arc LH-70" Electrode.

TOOLS—TAP and DRILL BLANKS





Cost Less with
CLEVELAND *Automatics*

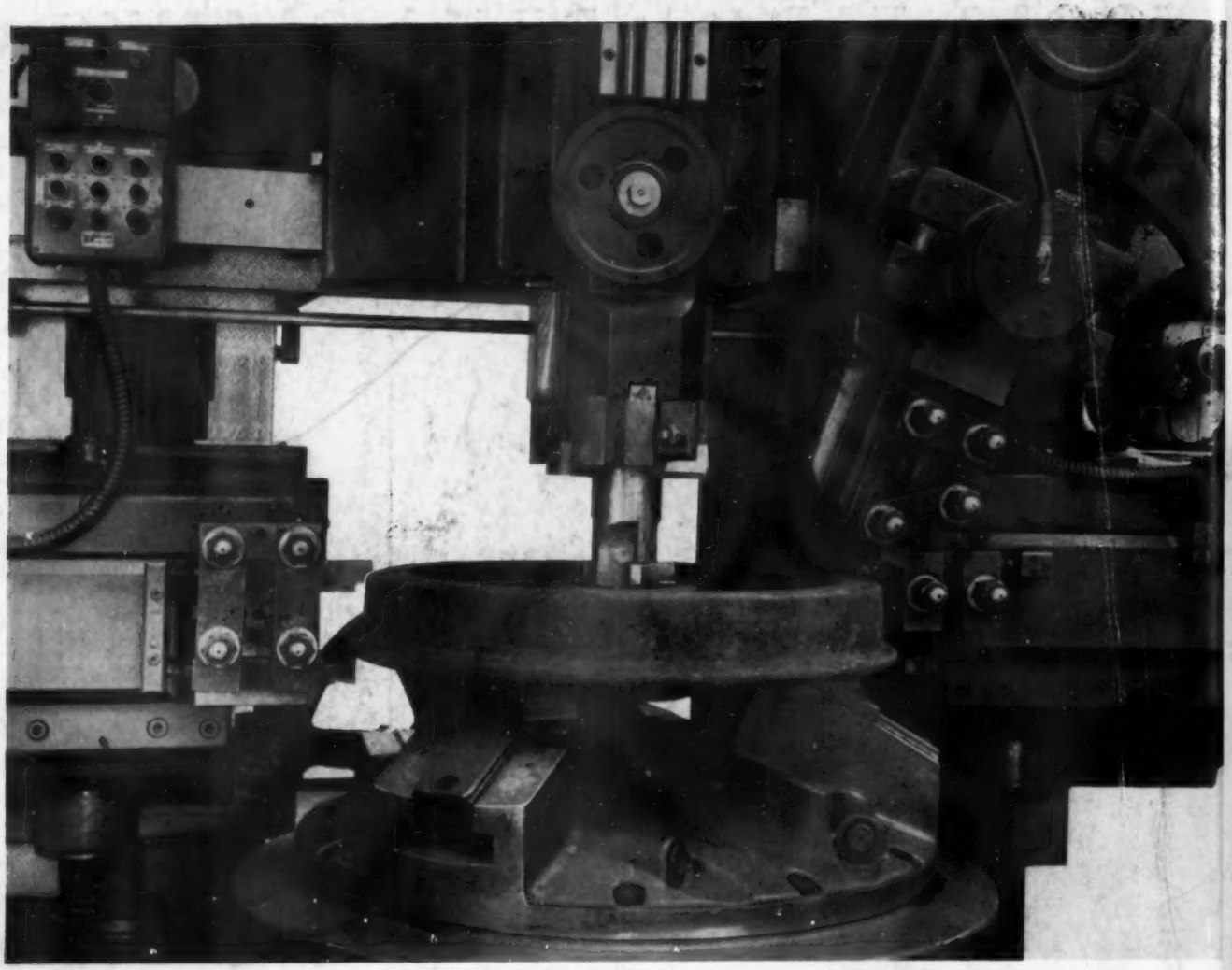
Obvious requirements in blanks for "shank" tools are precision and low cost . . . but definitely. Best answers are not always so obvious. Not all production planners realize the speed and accuracy with which such items can be produced on Cleveland Single Spindle Automatics . . . like the Model B machine pictured above automatically turning an "Easy Out". Very simple form, but it involves taper turning, end pointing. Other blanks, in prints, call for multiple diameters, chamfers, etc., all accomplished with speed at low cost on Cleveland Model B's. Sizes 9/16" to 2½". Check this against YOUR production problem.

THE CLEVELAND AUTOMATIC MACHINE COMPANY

4928 BEECH STREET • • CINCINNATI 12, OHIO

CHICAGO (6) 1408A Civic Opera Bldg. CLEVELAND (14) 1114 N.B.C. Bldg. DETROIT (2) 540A New Center Bldg.

HARTFORD (1) 529A Capital National Bank Bldg. NEW YORK (6) 2402A Singer Bldg.



New TIMKEN BEARING EQUIPPED Machine Revolutionizes Railroad Car Wheel Finishing

Thanks to this remarkable postwar development of the Cincinnati Planer Company, Cincinnati, Ohio, rolled steel car wheels now can be completely machined at the rate of approximately six wheels per hour — a considerable reduction in production time and cost.

An ingenious new chucking device assures quicker setting and accurate centering of the wheel and permits boring of the center hole simultaneously with the machining of the rim, flange and tread, resulting in a better balanced, better finished wheel.

Prominent among the provisions for precision, dependability, endurance and low maintenance are 19 Timken Tapered Roller Bearings applied on the input shaft, bevel gear shaft, table drive shaft, clutch shaft, spindle, rail head pinion and rail drive idler.

Any machine is a better machine when it is Timken Bearing Equipped, as thousands of manufacturers and users have proved. Look for the trade-mark "TIMKEN" on every bearing that goes in your equipment. The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

48 YEARS OF ENGINEERING AND METALLURGICAL DEVELOPMENT